Math Fact Mastery

Easy to Do!

An instructional methodology and structured format to rectify Math Fact Innumeracy (and Math Processing Skills) in all Socioeconomic Elementary Schools.

Blaine A. Helwig

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Executive Summary

There are four (4) components to a standard 90-minute math block: daily numeracy skill development, spaced repetition, the core lesson and problem solving. This document expatiates on solving the more difficult of the four (4) main components – numeracy skill development (i.e., math fact and math processing skills). Numeracy skills are the building blocks of successful problem solving. However, many of this countries' elementary students are not learning either of these two arithmetic skills to an automaticity level. It is not the students' fault; it is the methodologies that are employed in the classroom, or more accurately, not being used by educators. For the last 6 decades, the United States' academic results in mathematics clearly demonstrates that the accepted arithmetic methodology is poorly designed, irrational, unstructured, and confusing.

If dependent numeracy skill sets are deficient or missing, students have difficulty forming logical connections on higher ordered, but dependent skills. However, there are other adverse ramifications due to a lack of innumeracy and its associated effect on daily problem-solving applications. First, students are not able to consistently solve arithmetic application word or story problems since those problems contain two to four embedded numeracy math fact and math processing skills. Second, If students do not possess sound arithmetic skills, they struggle academically in grasping relatively simple algebraic concepts since they never readily mastered the arithmetic skill dependences. Students' poor arithmetic and algebra skill set foundations are the root cause of the vast majority of students not comprehending higher mathematics courses such as linear algebra, differential and integral calculus, differential equations, discrete mathematics, etc. Third, the lack of mathematics skill sets prohibits serious acclimation into higher paying technical jobs and careers where fundamental math skill sets are compulsory. Finally, a number of parents frequently acquiesce that their children are, 'simply not good at math' instead of questioning the math philosophy, methodologies and pedagogical practices at their child's school. Their children's math outcomes are the result of poor pedagogy and resource implementation – and unfortunately the norm in far too many elementary schools.

This document provides a proven methodology to change the numeracy thinking from past decades of chronic nonperformance. It provides the *Why, What, When* and *How* of a systematic process so that public school educators understand the main issues in heightening their children's mathematics performance. This process is simple and replicable, but it does take a structured plan and effort – as do all human endeavors that work well. However, the end result of eradicating these academic numeracy skill gaps is to eliminate the infamous and ubiquitous Achievement Gap. In pragmatic reality, when the ***numeracy skill gaps are eradicated, the Achievement Gap vanishes as well!*** It is important to note that eliminating the numeracy skill gap and providing grade level skill prowess only places the child in a position to be a successful problem solver. There is one more step to academic performance. Students must practice application and problem solving daily in accordance with a state's mathematics standards and student learning expectations. However, there is good news. Grade level problem solving and application is a much easier task to address when the underlying numeracy skills are soundly founded.

Finally, proven outcomes are important in any assertion or proposition in any professional field. The process and pedagogy presented in this document produced two (2) urban Title 1 National Blue Ribbon Schools, and both schools are featured for academic excellence by the United States Department of Education as National Blue Ribbon Profile Schools. Graham Elementary and Blackshear Elementary Fine Arts Academy in the Austin Independent School District (Austin, Texas) have also earned multiple-year Gold Ribbon School (Children At Risk – Houston) awards and a myriad of Texas Education Agency (TEA) high academic performance recognitions.

About the Author

Blaine Helwig is a locally, state and nationally recognized campus administrator and was the J. Walter Graham Elementary Principal in Austin ISD for over 9 years. In that time period, J. Walter Graham Elementary (an urban Title 1 school) experienced dramatic and sustained academic success with typical inner city challenging student demographics. From 2009 to 2016, Graham Elementary School's academic performance earned exemplary accountability ratings and every possible academic distinction by the Texas Education Agency. The school was honored as a 2012 National Blue Ribbon School recipient, and the campus was featured as a National Blue Ribbon Profile School for academic excellence on the United States Department of Education's website - one of only four schools in the country to receive this prestigious honor. The Graham campus has also been recognized annually by Education Non-Profit Organizations for high and sustained academic performance. Finally, the language arts, mathematics and science stop-gap resources implemented at Graham that produced heightened student success are currently used in many other Title 1 campuses and districts with similar high percentages of English Language Learners, minority and low socioeconomic student populations.

In 1985, after completing a Bachelor of Science degree in Architectural Engineering from the University of Texas at Austin, Mr. Helwig worked for seven years as a senior structural design engineer, analyzing and designing state and federal highway bridges. He was also employed as a civil engineer in California and Utah with the United States Department of Defense as a lead project technical engineer overseeing earthen and hydraulic dam construction and large civil works projects. At present, Mr. Helwig retains his license as a registered professional engineer in Texas with a structural engineering specialization. Finally, Mr. Helwig is extremely appreciative of the United States Military for their financial support for his college education. He is a proud veteran of both the United States Army and the United States Air Force.

Mr. Helwig was conferred a Bachelor of Business Administration in Accounting in 1992. During this period of business study, he pursued additional and concentrated coursework in both economics and finance. After working as an accounting director for a large library system in central Texas, he was alternatively certified to work as an elementary teacher by the University of Texas. He taught fourth and fifth grade self-contained classrooms in the Round Rock Independent School District for six years. It was during those professional years that extensive language arts, science, social studies and mathematics curriculum were developed. The initial design work on the numeracy and literacy stop-gap resources was completed, implemented and beta-tested in intermediate classrooms. Those stop-gap intervention programs significantly evolved during his Title 1 school experience and are currently used by tens of thousands of elementary students in both traditional public schools as well as charter schools across the State of Texas.

In 2004, he was awarded a Master's degree in Educational Administration from Texas State University and worked for two years as the assistant principal at Charlotte Cox Elementary in the Leander Independent School District, a suburban school district near Austin. He began work in the Austin Independent School District in 2006 as an Elementary Program Supervisor under the direction of the Associate Superintendent's Office. A year later, he started his principal assignment at J. Walter Graham Elementary and maintained that capacity until his retirement in the fall of 2016. In 2012, Mr. Helwig was recognized by the United States Department of Education as one of seven recipients in the country with the prestigious Terrel H. Bell award for school transformation for producing outstanding student achievement for all students regardless of race, language proficiency and socioeconomic status. He was also the 2012 recipient of the Central Texas HEB Principal Excellence in Education Award and a five-time nominee and a two-time finalist for Austin ISD Principal of the Year.

Currently, Blaine Helwig is a curriculum writer and a Title 1 education consultant in rural and urban school transformation. He is a cofounder of Celestial Numeracy, a daily numeracy program that presently serves over 90,000 elementary and middle students each day as well as a cofounder of The New 3Rs Academic Transformation.

Math Fact Mastery – Easy to Do!

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Student Math Fact Mastery – Easy to Do!

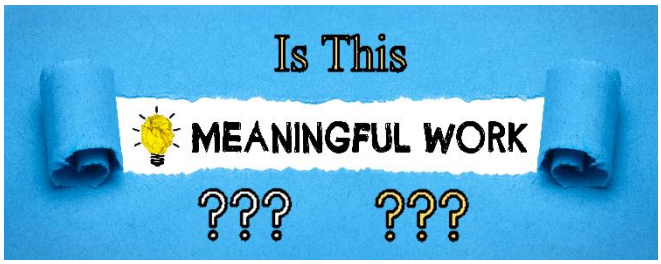
By Blaine Helwig

On July 20th, 1969, mankind demonstrated the ability to place men on the Moon and bring them safely back to Earth. This space journey is approximately a five-day 250,000 mile trek – one way. Oddly in comparison, educators have NOT found the methodology to ensure that elementary students' master their 4 operational arithmetic math facts (i.e., addition, subtraction, multiplication and division) to automaticity, and that sojourn is much less than a quarter million miles.

Something seems amiss here – for **IT IS** difficult to send a person to the moon, but it does not seem problematic for students to master four arithmetic operations either in an isolated classroom or globally in an urban, Title 1 elementary school regardless of enrollment levels. *And, fortunately, it is not overly difficult to ensure math fact mastery!* It is a task – like any other – that can be accomplished at any socioeconomic status elementary school!

<u>But, there is a catch!</u> There must be a plan, desire and effort on the part of both the campus administration and faculty to achieve any system process objective. Or, more pedagogically and pragmatically speaking, **IF** students are required to learn their math facts to automaticity (defined below), elementary educators must find **<u>value</u>** in students possessing this skill knowledge to justify investing the time and effort.

<u>WHY</u> is Math Fact Mastery to Automaticity Important?



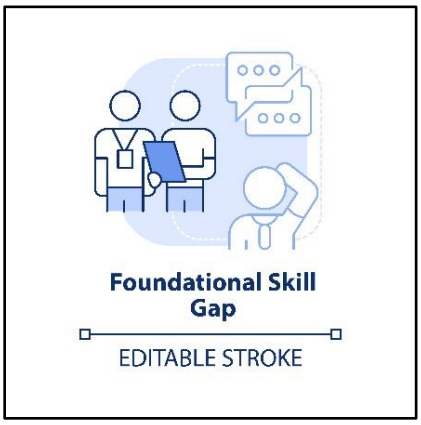
*"Why are we doing this?" Why do we **<u>need</u>** to do this?* Of course, before we discuss an effective math fact numeracy program, it is necessary to take a step back and discuss *'why'* this specific numeracy skill work is pragmatically or conceptually important. Hence, educators should always ask the following question prior to implementation of any curricular resource: *"**WHY** is this skill or learning process important for students to know – especially to automaticity levels in the case of math facts?"* So, let's delve into reasons that math fact mastery is essential arithmetic knowledge and teachers should press their students to automaticity.

- **First,** it is a required math standard in every State, and that alone should indicate it is a good idea. ***Why?*** Extremely experienced educators have debated this standard requirement for much longer than I have been alive, and for good reason. There is so much numeracy ability tied to a student's automaticity of their math facts and <u>*knowing what each fact physically represents*</u>. As any seasoned educator is aware, math processing skills are dependently and directly tied to math fact automaticity: multi-digit computations, estimation calculations, reducing fractions to lowest terms, changing fractions or decimals to equivalents (i.e., improper, decimal, proper and mixed number), finding equivalent fractions, prime factorization), and many more.

- **Second,** a student is positioned to understand mathematics at much deeper levels beginning in the second semester 2nd grade when their mental focus is not

compromised by counting on their fingers or drawing stick/circular diagrams on their paper to compute the answer to a basic math fact. It is important to note that a math fact is indeed a **fact**! Thus, it does not change ever in one's lifetime. 6 x 7 equals 42 now and forever – it is by definition a fact – it can be proven by repeated addition, arrays, equal groups, or an area representation.

- **Third,** Algebra! Students become lost and confused quickly when they do not possess automaticity in simple arithmetic computations while solving equations for variables and inequalities to the point that they often miss the conceptual aspect of algebra. **Note:** Every elementary teacher should be required to visit or watch a short video of a seventh-grade middle school algebra class and witness the demise of students who are arithmetically, math skill/numeracy deficient. After that middle school visit or video, there would be no question or debate why math fact automaticity is important based on that observation.
- **Fourth,** upon graduation from high school, many students enter university or vocational schools for further education. Currently, professional careers in the technical fields require mathematics (and science) skill sets. Competency in arithmetic, algebra, trigonometry and geometry are the fundamental perquisites for university level mathematics or vocational training courses. As an engineering graduate and a registered professional engineer in the State of Texas, I never met a junior or senior in my engineering classes or as a civil or mechanical engineer that was not highly adept in public school mathematics – ever!
- **Fifth,** the infamous achievement gap is actually a **SKILL GAP** in both mathematics (and reading). If students are not math fact and processing skill competent, then it is highly unlikely they will be able to solve multi-step application (i.e., word or story) problems. A word or story problem is nothing more than discrete, embedded numeracy skills in a series of sentences.



Math Fact Requirements and Automaticity Defined by Grade Level

1st and 2nd Grades: Adequate exposure to addition and subtraction – kiddos need to move from the tactile manipulative to pictorial representations (e.g., number lines, drawing dots, etc.) and finally, to paper pencil mental mathematics. At this age, many students will count on their fingers during this embryonic stage – and that is expected. However, the teacher should provide ample opportunities to their students so they begin to ingrain the most basic 1 digit math addition and subtraction facts from 0 to 12 (e.g., 0 + 5 = ? ; 6 + 7 = ? and 4 + 12 = ?). Let's define automaticity for both clarity and define student expectations for the task at hand.

- ***Automaticity* first grade** means completing 25 mixed – 1 digit addition and subtraction facts in 2 minutes and 30 seconds. Translation: 150 seconds divided by 25 problems is about 7 seconds per fact.
- ***Automaticity* second grade** means completing 50 mixed – 1 digit addition and subtraction facts in 2 minute and 30 seconds. Translation: 150 seconds divided by 50 problems is 3 seconds per fact.

Note: It is recommended to provide less problems in the primary grades for psychological reasons. Thus, 25 and 50 math facts are doable in the primary grades, respectively. Giving children 100 mixed addition or subtraction assessments will very likely be unnerving to many first and second graders, and it is unnecessary. There is adequate time to slowly adjust increasing more math facts in the intermediate grades with a structured plan.

3rd Grade: A minimum of multiplication facts – from 0 to 12 ***with*** associated physical understanding (e.g., 0 x 5 = ? ; 5 x 9 = ? and 12 x 11 = ?). Division facts are also easily mastered at this grade level with a simple plan.

4th through 6th Grades: Access and review ALL four math fact operations until students demonstrate automaticity to the standard – all four operations mastered to automaticity as well as physical understanding.

- ***Automaticity*** **third through sixth grades** means completing 100 mixed – 1 digit facts in each operation in 5 minutes. Translation: 300 seconds divided by 100 problems is 3 seconds per fact.

Note: The assessment should be a written one! Use a **written** 2 minute and 30 seconds or 5-minute math fact assessment. It is an essential ingredient to success so that students ingrain math fact knowledge into long-term memory.

WHAT Achievement Results are Expected and WHAT Digital Tracking Program?

The second question an educator should ask before implementing any curricular program or methodology is, *"**WHAT** student outcomes can be expected from our work?"* Using the method described in this short document – all students classified as general education, and a majority of students receiving special education services will master their four (4) math fact operations by the end of third grade. The author can attest that the described methodology **resulted in approximately 98% of intermediate students possessing grade level automaticity** every school year for 13 consecutive years in an urban, Title 1 elementary school. Those academic results were emulated by other elementary schools that followed the same methodology in both non-Title 1 and Title 1 elementary schools. It is important to note that if students are receiving special education that their Individual Education Plan (IEP) must be followed to the letter of the law. It is a legal and binding document. Also, if a student has known processing issues (e.g., 504 services), the teacher should modify the standards so the student has a reasonable and achievable goal. These modifications affect a small number of students, but the teacher needs to use a case-by-case approach with each child.

Another ***'what'*** question exists in the case of math fact tracking to alleviate the burden of daily numeracy preparation for each student. Thus, *"**WHAT** digital tracking program should be used to provide efficiency, monitoring and distribution of math fact assessments?"* There are several choices that school or district personnel may select; however, the author believes the best choice is Formative Loop (www.formativeloop.com) daily numeracy program for many reasons. **First**, it is an individualized blended (hybrid) program where each student writes a five (5) minute assessment. Then, after an adult quickly inputs the assessment results into Formative Loop, the computer program not only tracks the students' progress in real time but it provides student ordered assessments ready for daily distribution. **Second**, Formative Loop offers a written assessment. Digital math fact and numeracy programs that offer *only* visual computer screen format are NOT as effective. The fact that a student physically writes the assessment appears to invoke a psychometric response in their brain that allows students to ingrain math facts into their long-term memory. **Third**, the computer program offers a homework option to provide targeted practice on the skill, and it includes a build-up feature for each math fact operation which is key for student learning. **Fourth**, Formative Loop offers a free resource library for each grade level, so the teacher has a treasure trove of available processing math skill or math fact skill, as needed. This resource library assists teachers in all aspects of lesson planning and instruction. **Fifth**, all student results and overall performance may be viewed in real time from any computer since Formative Loop is a web-based numeracy program. Thus, a struggling student allows a teacher to identify, motivate and intervene with that student – thus, affording targeted intervention for each child in the class or school. **Sixth**, Formative Loop not only has a math fact component, but it also provides a math processing skill scheme as well for the same low price. Thus, there are two possible schemes that may be selected. One – a math fact and

processing skill scheme combined – one five-minute formative assessment each day. Or, two – two (2) separate five (5) minute assessments each morning – a math fact and a math processing skill scheme. At our National Blue Ribbon recognized elementary schools, we opted for the second option since we wanted ninety (90) percent of the math facts completed by students at the holiday break in December – the end of the fall semester. Using the two-tiered formative assessment system, there is ONLY **one** five (5) minute math processing assessment after the student finishes the math fact scheme, but during the fall semester, both skill areas were simultaneously monitored in real time. **Seventh**, the one or two five (5) minute daily assessment(s) can be given to the students as they arrive in the morning to class. Hence, no math class minutes are lost and there is sufficient time to grade, input and provide intervention as needed throughout the day. **Eighth**, Formative Loop is a flexible program with regard to grading and inputting daily assessments as well as providing any interventions as required. There are two options to consider in this area as well. Either classroom teachers grade and input the student assessments, ***or*** volunteers, an administrator, teaching assistants or an instructional specialist grade and input the five (5) minute daily assessments. At our schools, we opted for the latter option (i.e., **external** grading and inputting) to ensure conformity of grading and high-quality controls for all classroom. Additionally, Formative Loop offers flexibility of grouping student intervention groups to press all students for academic success. This functionality permits an interventionist to look at the daily assessments and group 5 or 6 students who may have difficulty with place value expansion to the thousands place value, for example. **Ninth**, if academic performance at the campus is a priority, it is possible to monitor elementary and middle schools regardless of school enrollment size. Hence, students do not 'slide by' and not learn their arithmetic skills to the state standards. **Finally**, the price of Formative Loop is inexpensive – 7 dollars per student for the entire school year as of the writing of this document.

WHEN are Achievement Results Realized?

The third question focuses on *expected* student outcomes, and results should always be addressed prior to implementation of any proposed curricular program. Otherwise, the new curricular program is non-accountable and classroom work may go on for years without any indication if the new program or resource is effective. Thus, the third question that should be asked is, *"**WHEN** will the data show a significant and expected rise in student outcomes?"*

Another area that requires definition is identifying the metric that student achievement is evaluated. Is the metric a qualitative or a quantitative data analysis? In the core subjects (i.e., mathematics, reading, writing or science), the author believes student achievement must be an objective analysis as opposed to a subjective one. Thus, standardized testing is the most objective means to evaluate if a core subject curricular program is effective or not. Moreover, it is ultimately the means that campus academic performance is measured with regard to a state's education agency as well as in the eyes of the general public.

It is important to note that implementing Formative Loop and pressing it to fruition prepares students in becoming successful problem solvers. In short, daily numeracy (i.e., math facts and math processing skills) positions students to be READY to successfully solve a word or story problem that is comprised of embedded numeracy skills. For example, a typical 4th grade elementary word/story problem from a standardized test is provided below; however, *in order to correctly solve the word/story problem*, the student must be proficient at the following discrete numeracy skills: multiplication and subtraction facts; place value, rounding and

estimation skills; multi-digit subtraction skills; and mathematics vocabulary usage (difference). If the student is NOT proficient in any one of these numeracy skills, the likelihood of a correct solution is not high.

Betty runs 3 miles every Tuesday, Wednesday and Thursday. On Mondays, Fridays and both days on the weekend, she jogs 7 miles per day. Estimate the difference in total miles when she runs 7 miles a day compared to the total number of miles when she runs only 3 miles per day?

Again, daily numeracy enables students to be positioned to successfully engage in the problem's computations; however, the student must practice solving 'word' or 'story' (application) problems as well. ***Hence, the other half of the equation to generate high student outcomes are the core daily lessons that press skill level development and a daily problem-solving resource*.** The author has coined the term problem-solving resources as 'bridge resources.' For more information on these resources, please read the following two blogs located at the website provided in the document's footer: **Bridge Resources and their Academic Need** – and – **Word Problems: Student Benefits and Teaching Tips**. It is important to note that if improving performance on any task is a desired goal, then it must be practiced in a structural and predictable means.

Hence, if both problem solving and daily numeracy are prioritized on a daily and consistent basis, then it will **only take one (1) school year to see dramatic results in student achievement**. Struggling academic Title 1 schools can achieve standard testing gains from 30 percent student passing rates to the 80's and 90's in one school year! For instance, in our Title 1 elementary campuses, student outcomes dramatically increased in the first year of implementation – from the mid 50's and low 60's to the high 90 percentage marks.

With effective classroom management, daily problem solving as well as **pressing** daily numeracy via Formative Loop, it should only take one school year to achieve significant increases in student outcomes regardless of the socioeconomic school status of the campus. Finally, after the first year of implementation, the following school years, daily numeracy is much easier since students' progress to the next grade with heightened numeracy and problem-solving skill sets. Thus, the academic results achieved are sustained for as long as the program is implemented.

HOW to Implement an Accountable and Performance Driven Daily Math Fact Program!

The final question – outside of Who is accountable for the curricular program is, *"**HOW** do I implement an accountable and performance driven daily numeracy program?"* Or, more directly, what are the specific steps to implement a high performing numeracy program in either a classroom or schoolwide?

Since Formative Loop offers a build-up process for each math fact operation, many schools put the program in place and do a hands-off approach. This type of curricular program management is NOT recommended. If high results are desired, a teacher and campus administrator must act like athletic coaches and motivate students to perform well. They must provide extra practice and attention to struggling students, or the classroom's/school's pedagogical system and student learning philosophy evolves into *'If the students get it, they get it. If they do not, they don't!"*

If the following proven curricular numeracy system is implemented and thoroughly pressed, almost all students in a class or school will demonstrate grade level mathematics prowess on the classroom activities and on annual standardized examinations. The most effective numeracy program is a symbiotic approach between daily classroom mini-lessons (i.e., spaced repetition) on specific numeracy skills in conjunction with Formative Loop. Of course, the build-up math fact sequence (i.e., 0's, 1's, 2's, 3's, to 10's for each math fact operation)

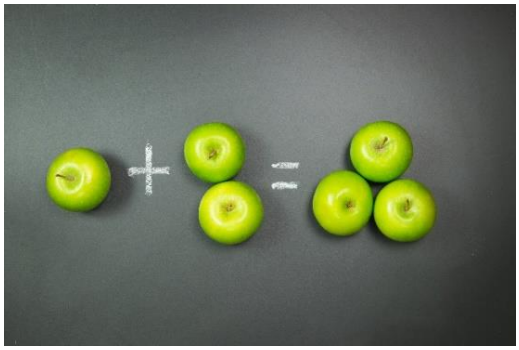
ensures that students are prepared for the final mixed assessment for that operation; however, the inclusion of specific numeracy skills (i.e., Making 10, Doubles, etc.) places students on a fast-track toward mastering the facts in those individual sequences. It is important to understand that Formative Loop will work without using mini-lessons/spaced repetition numeracy skill classroom work; however, this pedagogy is one of the most effective and efficient guided math methodologies. Its inclusion at the onset of the core math block will dramatically expedite the math fact (and math processing skill) student learning process.

It is strongly recommended that the classroom teacher or the school principal select the Formative Loop **dual sequencing** for both math facts and math processing skills. This means that there are two (2) five (5) minute assessments per day, but once a student masters all four (4) math fact operations, then there is only one (1) five (5) minute math processing skill assessment. Additionally, there is so much numeracy ability directly tied to math fact mastery that the extra effort of campus educators is rewarded in due course; however, the major advantage is that students are simultaneously learning and mastering both math facts and math processing skills. Finally, many primary-aged students will arrive in third grade with primary grade math fact mastery in both addition and subtraction, consequently, it is recommended at the beginning of third grade that students be held accountable for mastery of all four (4) operations at a 3 second per math fact mastery standard.

Note: The teacher or school principal may need to request the Formative Loop dual sequencing fact and processing skill sequences from that company. The price per student is the same as a single sequence numeracy scheme that includes both math fact and math processing skills, but student performance will be much higher using the two (2) five (5) minute assessments each morning. Also, if the two (2) five (5) minute assessments are completed in the first 15 minutes of the school day as students arrive to school, there is ample time to grade and input the two (2) student assessments as well as conduct any needed interventions during the school day. Again, using this type of programming, the daily assessments do not deduct instructional minutes from the standard ninety (90) minute core math block.

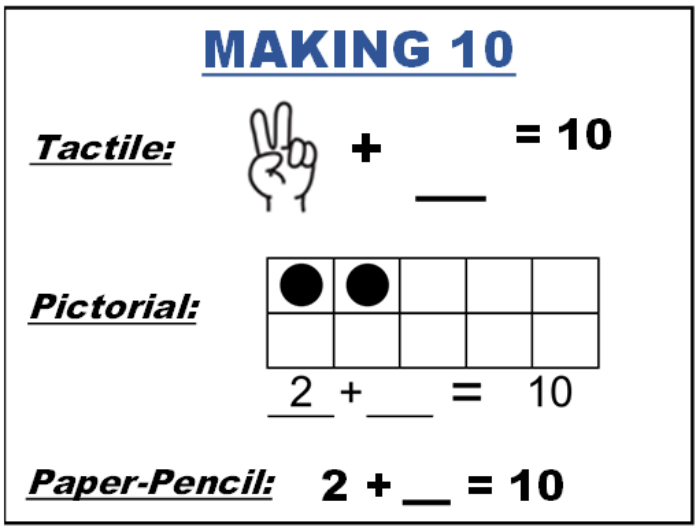
Note: Formative Loop always begins each student on the final mixed assessment on each of the four (4) math fact operations to evaluate if the student already possesses mastery of that skill. If not, then the student is moved to the build-up process starting at separate assessments of the 0's (e.g., 0 + 3 = ? ; 5 + 0 = ?). Then, after mastering the 0's, the student is moved to the 1's (e.g.; 1 + 8 = ? ; 4 + 1 = ?), and then, the 2's, 3's, 4's, etc. This layered practice provides students with the ability and confidence to do well on the final mixed of the math fact operation. **Tip:** A student is able to copy the above line in the skill build-up and not ingrain their math facts at each layer. If a student is exhibiting this behavior that is not conducive to learning, require the student to cover each completed horizontal line/row of addition facts with a separate piece of paper – depriving students of the ability to copy the (completed) above rows. Homework is also provided via the Formative Loop program on the specific skill that student is assessed. It is highly recommended to utilize the program's functionality and provide students homework so they are given ample practice and do not arrive to school each morning expected to complete a five (5) minute assessment, cold turkey. Finally, on each assessment, there is a black star (★) that provides the adult grader with a **recommended** place for skill resource mastery. However, this black star is only a recommendation, and the grader should use their educational judgement based on their knowledge of each student (e.g., student receiving special education or 504 services).

Addition Math Facts



As noted above, the most effective approach to math fact and math processing skill mastery is a symbiotic approach using a 5-to-10-minute mini-lesson (i.e., spaced repetition) at the onset of the core math lesson and simultaneously implementing Formative Loop. Consequently, the teacher should conduct a short mini-lesson that reviews at least three (3) skill areas. In the case of math facts, those three (3) skills areas are Making 10, Addition Doubles, and Multiples (skip count single digits from 1 to 12) practice. ***In the primary grades*** (i.e., first and second), teachers should always sequence these skills with their students in the following sequence: tactile, pictorial *and then and only then*, paper-pencil independent exercises. For intermediate grade level (i.e., third through sixth grades) teachers, the basic implementation recommendations are provided below.

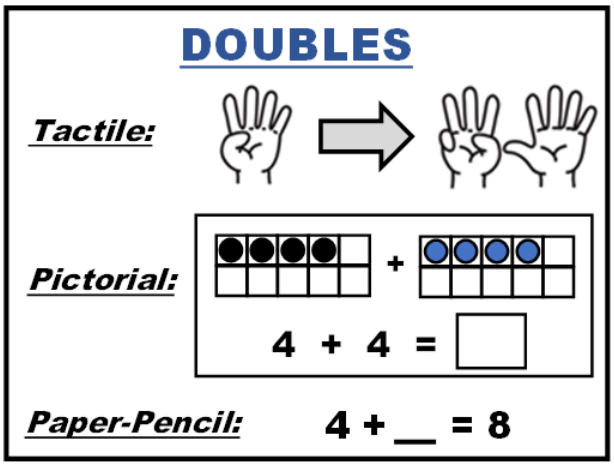
Making 10 – An intermediate grade level teacher *may elect* to begin this skill activity with either a tactile, pictorial or paper-pencil approach depending on the needs of their students. For tactile, the teacher can show 2 fingers, and their students would respond with eight fingers (i.e., 2 + 8 = 10). It is recommended teachers begin with the numbers close to ten in the beginning – 7, 8, 9, or 10. Use only these four numbers for a couple days until students have mastered them. Then, extend the possible numbers to 5 and 6 and Make 10. Include the remaining digits/numbers (0 through 4) as the students are prepared to transition. The teacher should be closely monitoring students that academically struggle to ensure that they can demonstrate mastery and are ready to move on. Provide those specific students extra practice as needed during the day – when they are lined up to go to recess, specials/essential areas, lunch or dismissal, for instance. The pictorial model is also easy to facilitate in this short minilesson 'spaced repetition' session. The teacher can quickly draw 7 dots on the white board, and the students show the number of fingers to Make 10. The paper-pencil aspect should be used last when the students prove they are aptly prepared for mental mathematics. Those resource sheets are provided at the end of this document, and they are also in the Formative Loop math processing skill sequence. As previously mentioned, the Formative Loop program offers a free resource section per grade level from first through eighth grade. Those resources contain almost every math fact and processing skill for that grade level, and a teacher may need access to grade level skill resources either above or below their students' current grade level to differentiate for varying student needs.



Note: Making 10 is an extremely important numeracy skill since it is Base 10. Making 10 is the same skill set for Making 100; Making 100; Making 1,000, etc. Example: *Make 10:* Given a 3 – Answer: 7. *Make 100:* Given a 30 – Answer: 70. Thus, a Base 10 system on requires adding a zero (0) to a number. Paper resources are attached at the end of this document.

Note: The Making 10 skill set can be used for subtraction math facts, too – single digit from double digit math facts (e.g., 15 – 6 = ? and 13 – 9 = ?). Information provided in that section of this document.

Doubles – Doubles is similar to the 'Making 10' skill exercise, and it also possesses numeracy value. In this pedagogy, the teacher can show 4 fingers or write a '4' on the class white board, then students respond by showing a doubling of that number with the correct numbers of fingers extended using their hands. Or, students can use a small white board and show the teacher the number '8' that indicates the correct sum for doubling the number '4.' It is important to note that if using a finger



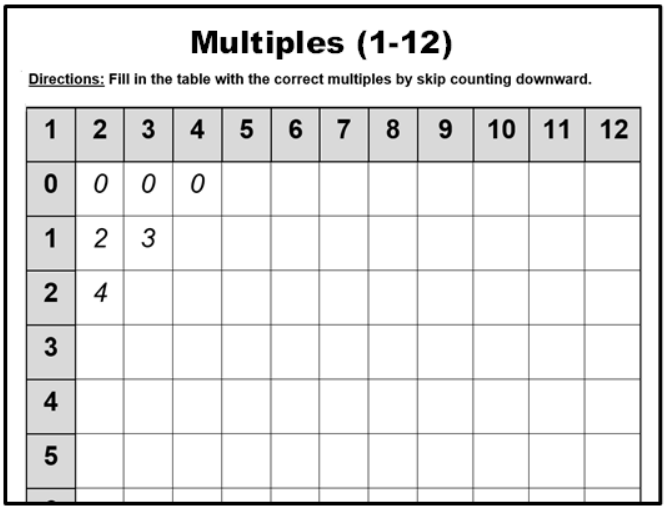
approach, *fingers should be shown using two hands*. For example, if 4 is written on the white board, then students should show five fingers on one hand and three finger on the second raised hand. They should **not** show two hands with 4 fingers extended on each hand. In that case, students are parroting the teacher's hands, and not clearly demonstrating understanding.

When the teacher arrives at doubling 6, the students can either write '12' on a small white board to visually indicate their response; or, they can show a quick closed fist (i.e., representing the number 10) and 2 fingers. Again, the teacher should begin with small numbers (1, 2, 3, and 4), then repeat each day until those digits are mastered. At that point, the teacher may add 5 and 6 and larger numbers sequentially until the number '12' is reached as students demonstrate readiness. Again, the teacher should be observing any students that struggle to ensure they are 'coming along for the academic ride.' As needed, provide them ample practice during the transitions.

Note: When this spaced repetition pedagogy is used as described above, it is recommended the teacher observe the lowest academic students in the classroom. When their learning threshold is met and they demonstrate skill mastery, then the educator can be assured all students own the skill. Since the sessions are so rapid and repetitive each day, students who have mastered the skill do not become bored with a couple extra days of practice.

Note: Once Doubling integers is mastered, the teacher can extend this baseline knowledge to expand their addition fact knowledge to Doubles MINUS ONE and Doubles PLUS ONE. For example, if 2 + 2 = 4, then 2 + 1 = 3 and 2 + 3 = 5. Paper resources are attached at the end of this document.

Multiples – Multiples fluency (i.e., skip counting) is a key aspect of arithmetic numeracy for elementary students. Begin this exercise with single digit numbers from 1 to 12 (see picture). Like all else, the pedagogy should be structured and sequential for successful student learning. First, the teacher should chorally count with the students. For instance, a teacher may elect to write the multiples as the class is collectively reciting the multiples. Then, the teacher and students can chorally count together. Second, the teacher can require students to skip count by writing multiples of a given number and a set time limit – for instance, 15 or 20 seconds. For example, the teacher may write 5 on the classroom white board or show students his/her hand with 5 fingers, and students **write** with dry-erase markers on their white boards. Students can also use dry erase markers on their desks or by traditionally writing multiples on a piece of scratch or notebook paper. *It is highly recommended that the above activities be completed both orally and written*. Finally, students should be required to complete a Multiples exercise via writing the numbers from 1 to 12. This Multiples (1-12) exercise should be completed in five (5) minutes for third through sixth graders after students have been sufficiently prepared. Additionally, homework should be provided each night at this time to ensure students are practicing until students demonstrate mastery in the five minute timed period.



Multiples (1-12)

Directions: Fill in the table with the correct multiples by skip counting downward.

1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0								
1	2	3									
2	4										
3											
4											
5											

It is important to stress that the teacher should begin skip counting activities with the easier multiples (i.e., 2's, 10 and 5). After the class has mastered those three numbers via skip counting, both orally and written, then the teacher should begin including daily practice of 3's, then 4's, until the 12's are completed. Once a specific number is mastered, the teacher should replace that number from the daily spaced repetition (minilesson) practice with a new multiple in the sequence. The minilesson/spaced repetition pedagogy should require approximately 10 minutes of the ninety (90) minute core lesson. These rapid spaced repetition (mini-lessons) sessions on Making 10, Doubles, Multiples, etc., etc., etc. should continue until ALL students have mastered the content.

Note: It is likely that many students will require assistance counting by 12's. It is recommended to start slowly. On the first day, only count to 36 or 48 (i.e., 0, 12, 24, 36, 48). Then, add additional multiples of 12 until 120 is reached.

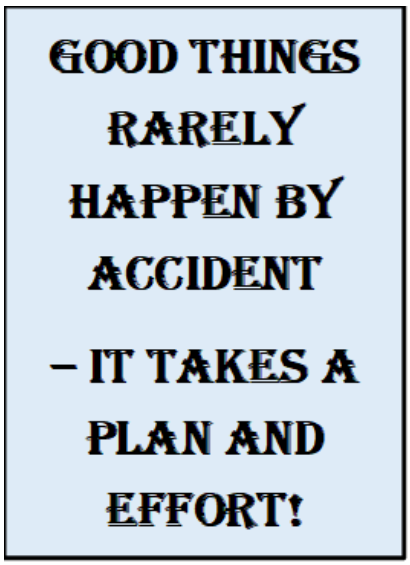
Note: Learning to skip count 12's is important for feet and inches equivalencies. Skip counting 15's is useful for time/clocks – quarter of hours. Skip counting 25's is important for money – quarter dollars. Finally, the first multiple of any number is always zero (0). Example – multiples of 3: {**0**, 3, 6, 9, 12, 15, 18, 21, 24, …}

Note: Mastering multiples/skip counting from numbers 1 through 12 will help provide students a physical meaning when they are learning multiplication facts. Notably – that multiplication can be viewed as repeated addition (i.e., multiples) of the same number. For example: (0, 6, 12, 18, …) or 6 + 6 + 6 = 18 or 3 x 6 = 18.

Addition is a commutative property; consequently, 4 + 5 = 9 and 5 + 4 = 9 compute the same sum as the two addends can be transposed. The commutative addition property divides the number of addition math facts to be memorized by a factor of 2. Thus, a student is only required to memorize 36 discrete addition facts from the 2's to the 9's, inclusive. However, if a student masters Making 10, Doubles and the Doubles PLUS ONE work in the classroom, then they must only learn 14 discrete addition facts (i.e., 5 + 7 = ? ; 8 + 3 = ? and 9 + 7 = ?). With students working simultaneously with Formative Loop build-up addition sequencing, children are extremely successful at mastering all of their addition facts from digits 0 through 10 in only a couple weeks.

Subtraction Math Facts

For many intermediate grade level students, subtraction is invariably the most difficult of the four (4) math fact operations to master – 100 mixed (i.e., 0 to 18 single and two digit) problems in 5 minutes or less. First, unlike addition, subtraction does not possess a commutative property. Thus, 15 – 8 = ? and 15 – 7 = ? are two (2) separate problems to children since in this case, the 15 and 8 or 15 and 7 cannot be interchanged without changing the context of positive and negative integer mathematics. Thus, students do not benefit as they did from the addition math fact commutative property and must memorize many more math facts in subtraction. Second, children are much better at augmenting two objects as is done in addition than finding a difference between them. Finally, the concept of a difference between two numbers is more difficult to physically grasp for many students – even when a number line is used as a pictorial manipulative. Consequently, subtraction is more difficult than addition, but it is also doable in an expedited manner with a plan and a consistent systematic process.



Formative Loop's numeracy program is exceedingly helpful in its individualized worksheet distribution for each student and its progress monitoring for either a teacher and his or her classroom, or a campus administrator regardless of student enrollment. The program's functionality with its build-up math fact from the zero (0) to ten (10) will provide subtraction fact mastery typically over three or four weeks; however, as with addition, there is a classroom spaced repetition methodology that presses the student learning process more rapidly.

Approximately seventy (70) percent of the students will achieve subtraction math fact mastery using only the Formative Loop program without additional educator effort. Still, an educators' goal is for **all** students to master their math facts – including students possessing a cognitive disability (e.g., students receiving special education services). It is important to note that students receiving special education services with *significant* disabilities can also be successful but their mastery stipulations should be determined in accordance with their IEP.

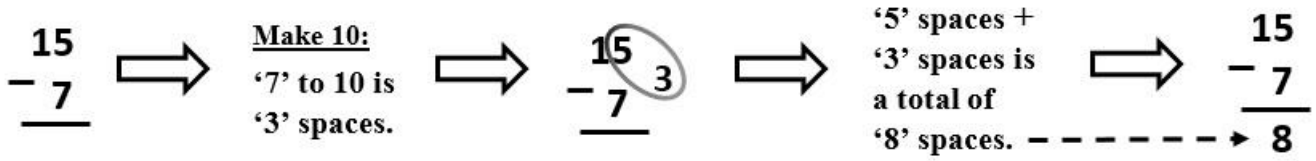
If certain students struggle with their math fact memorization – like subtraction – they should be provided extra practice and strategies to press them to completion. There are three (3) strategies outlined below that are highly effective in pressing intermediate grade level students to subtraction math fact completion.

1.) The vast majority of students are able to subtract one-digit math facts from one-digit math facts (e.g., 7 – 4 = ? and 9 – 2 = ?) with relative ease. But, a significant number of students struggle to master the one digit from two-digit subtraction math facts, let's discuss several strategies that assist students to master subtraction facts to automaticity. During the addition fact stage, students mastered the processing skill 'Making 10' for digits 0 to 10. Thus, using the 'Making 10' skill in combination with addition fact mastery, students possess the ability to memorize the more difficult subtraction math facts very quickly using a simple strategy employing both skills. As a matter of fact, it is the means by which the author subtracts one digit from two-digit math subtraction facts to this day.

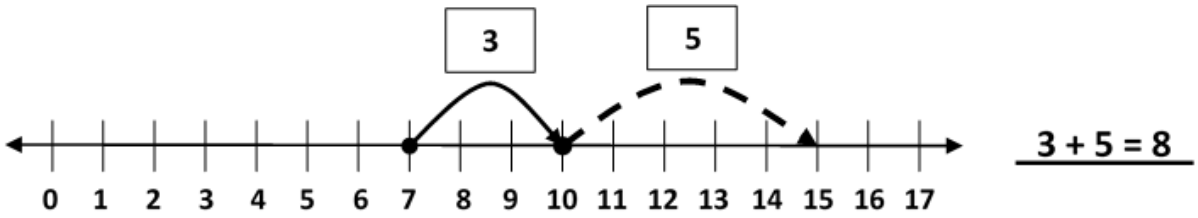
   For example, given the subtraction math fact 15 – 7 = ?; students 'Make 10' with the subtrahend (i.e., the number 7) and add it to the one's digit in the minuend (i.e., the '5' in 15) to obtain the difference.

   The diagrams below explain this learning process from a visual perspective.

   The difference in subtraction is ALWAYS the total number of spaces between any two integers. Thus, there are a total of 8 spaces between 7 and 15.



   It is highly recommended that students are shown this process using a whole number line repeatedly until mastered. In short, students must understand the physical mechanics of the process, or they will be confused at some point. Of course, it is imperative that students understand that the process *is a very quick means to find the total number of spaces between the two integers or the difference*. It is also paramount that the students are adept at the Making 10 numeracy skill or they will be learning two



The difference of 15 – 7 is a total of 8 spaces. Hence, 15 – 7 = 8

   different skills – Making 10 and finding differences. Students should ONLY be learning subtraction at this stage of the pedagogy.

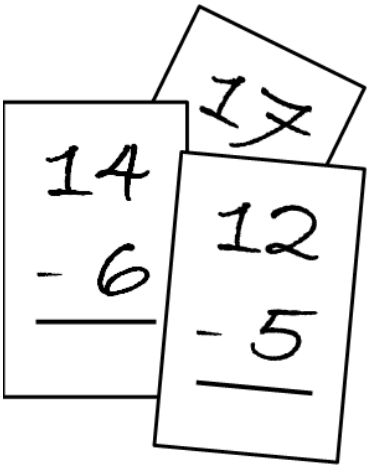
Note: If students do **NOT** understand the physical meaning of why Making 10 works in these subtraction cases, students will INCORRECTLY attempt to use this method with one digit from one digit subtraction facts (e.g., 5 – 3 = ?). Thus, this method works with ONLY 1 digit from 2 digit subtraction math facts (e.g., 14 – 9 = ? and 17 – 8 = ?) **since the difference includes the number 10 between the two integers.**

Note: It is of paramount importance that students are taught that subtraction means the number of spaces between two numbers/integers because subtraction always possesses the same physical meaning when computing differences. For instance, when a student is subtracting negative and positive integers such as: (-4) – (+5) = - 9, subtraction remains the difference between the two integers. Since there are nine (9) spaces between -4 and +5, the difference is 9. Of course, the answer or difference is a negative (-) nine (9) since the process subtracts a larger integer (+5) from a smaller integer (-4). If we reverse the integers in the equation so, (+5) – (-4) = + 9, students will discover there are still nine (9) spaces between the two integers (-4 and +5), but a smaller integer (-4) is subtracted from a larger integer (+5) so the overall difference in this case is a positive (+) nine (9). Mathematically, students need to understand that subtraction operations are ALWAYS the *difference* in *the total number of spaces between* two integers or decimals or fractions.

2.) Another strategy to press students to math fact mastery is by creating an additional class of students using Formative Loop's functionality. Formative Loop allows any number of separate 'classes' to be created for math facts or math processing skill schemes. This affords the teacher or an entire grade level of teachers to place struggling students in a separate Formative Loop ad hoc classroom and an ***intervention student group is created – which is exceedingly beneficial not only organizationally but individual student accountability***. For instance, if a large elementary school has eight (8) third grade classes but there are a total of 25 students in those 8 classes that have not mastered their subtraction facts, then a separate ad hoc class can be created with only those children included in the intervention class. Thus, the newly created class can be hypothetically named, "THIRD GRADE ADDITION FACTS" or "THIRD GRADE SUBTRACTION FACTS." Then, those students can be pulled for a quick five (5) minute practice session. If the student passes, promote him or her to the next level (e.g., from subtraction 4's to subtraction 5's) when you input the results. This functionality affords the teacher or the principal to print and prepare all the assessments in seconds, and when a student completes the math fact, they are removed from the intervention class. At that point, the educator can update their normal classroom math fact scheme of their progress. In doing so, the students will soon realize that they will NOT 'slide' by unnoticed, and that they will be held accountable to learn this important numeracy skill. It invariably creates a strong positive relationship and bond between the teacher or interventionist or the principal. It has been the author's professional experience that when students realize that their teacher, interventionist or principal puts time, assistance and encouragement into their learning, children respond by expending tremendous effort to succeed.

3.) ***Diagnostic*** **Math Flash Cards** is the last strategy to press students to math fact completion. Diagnostic flash cards are an incredible tool for students mastering the **remaining** six to ten math facts in any one of the math fact operations (i.e., addition, subtraction, multiplication or division). As students build their math fact knowledge from the 2's to the 9's – step by step, they steadily and slowly ingrain the math facts to long-term memory. However, when students complete the math fact build-up and begin the mixed assessment for any of the four (4) math fact operations, a handful of students invariably struggle with specific but small number of math facts.

For example, in subtraction, if students are not using the 'Making 10' method, their nemesis will most likely be a series of one digit from two-digit subtraction problems that act as an impediment from finishing a mixed assessment in five (5) minutes. When the educator or volunteer is grading the student's mixed assessment, they immediately notice the few remaining facts that the student skipped. This diagnostic opportunity should not be missed or overlooked. *The student is indicating the precise*



areas of math fact need on that mixed assessment by the unanswered math fact problems. It is highly recommended that the educator uses 3 by 5-inch blank index cards and create 6 to 10 math 'diagnostic' fact cards that the student has NOT mastered to automaticity. These practice cards should be given to the student with the following advice, *"These are the 'subtraction' facts that you do not know.* ***ONLY study these few facts*** *tonight with your mother, father or an older brother and sister. Then, tomorrow morning you will know them."* A common educator mistake is to give the child an entire set of flashcards to study at night in lieu of only the 6 to 8 specific fact cards that they do not know. If the student is provided an entire set of math fact flash cards, they do not specifically study the facts that they do not know.

Yet another effective method is for the student to turn their assessment paper over to the blank side and write the two or five math facts that they do not know, ten (10) times each. As with the diagnostic flash cards, this exercise aids the student in memorizing the last remaining subtraction (i.e., addition, multiplication or division) math facts that they have not committed to long-term memory. Again, using this method, the child studies ONLY the few facts that they do not know. Then, at dismissal or when the interventionist/principal encounters the child in the hallway, they can ask them those few subtraction (e.g., addition, multiplication or division) math fact problems.

Note: The above recommendations will provide ALL students the ability to do well when memorizing their math facts in all four operations. However, this process is **NOT** going to happen by accident. There must be a structured plan, consistency, methodology that is effective and motivating of students to press them to success. Happenstance will not likely press Title 1 campuses to high student achievement. What will be effective are highly organized structures in the student learning processes – as the ones described in this document.

Multiplication Math Facts

Back to easy, again. Multiplication possesses the same commutative property as addition. Hence, 5 x 7 = ? and 7 x 5 = ? are the same math fact since the two factors can be interchanged at will. This makes the total discrete multiplication facts to memorize from the 2's through 9's at 36. However, the 2's are nothing more than addition doubles, and if the teacher does simple mini-lessons/spaced repetition on perfect squares (2 x 2, 3 x 3, 4 x 4, etc.), the total number of discrete facts is only 20. There is more good news. If the teacher stresses the multiples 1–12 numeracy skill via oral and written practice from the time students began their addition fact work, multiplication facts for the vast majority of third (3rd) grade students complete this memory task to automaticity in a little over two (2) weeks. ***Why?*** Students immediately have a physical understanding of multiplication from their multiples work in the form of repeated addition as well as they are only memorizing a total of twenty (20) discrete multiplication facts.

For the small group of students that struggle, use the same Formative Loop intervention class and the diagnostic flash cards described above in the subtraction section. There are other small but helpful tips – to assist students toward mastering their multiplication facts. First, there are only two math facts between 50 and 60: 9 x 6 = 54 and 7 x 8 = 56. However, the product of 7 x 8 is a **5, 6, 7, 8** counting mnemonic memorization pattern. Thus, when a student sees 7 x 8 or 8 x 7, they immediately recognize the product is 56. Again, 5, 6, 7, 8. This often reminds students that the other fact's product in the 50's, is 54 (i.e., 9 x 6). If the teacher presses perfect square mini-lessons,

that helps students with 8 x 8, but the only other multiplication math fact in the 60's is 9 x 7 which equals 63. There is only one fact in the 70's – 8 x 9 and one in the 80's – 9 x 9 = 81 – another perfect square. If these small reminders are stressed, several of the more challenging math facts are easily learned.

> **Note:** Students may find an old Russian peasant math mnemonic interesting and quite possibly, helpful. The two-handed multiplication works **ONLY** for **multiplying by 9** (e.g., 9 x 2 = ? ; 5 x 9 = ? and 8 x 9 = ?). Here is how it works: Hold both hands out with all digits/thumbs and fingers extended – palms to the ground. If the product of 3 x 9 is desired, curl the 3rd (middle) finger from the left – the third finger on the left hand. There are two (2) fingers to the left of the curled finger and seven (7) extended to the right of that finger. Hence, 3 x 9 must equal 27. Another example, 9 x 9, curl the 9th finger from the left – the fourth finger on the right hand. There are eight (8) fingers extended to the left of the curled finger, and there is only one (1) finger extended to its right. Thus, 9 x 9 is equal to 81.

Division Math Facts

Division math facts are also not much of a challenge. The multiples work completed earlier is really good for connections and meaning. Most students recognize the connection between multiplication and division since the numbers are the same. However, *it is a common mistake* to simply inform students that '*division is the opposite of multiplication*,' and then, leave them to their own devices in learning the operation.

Instead, third grade teachers must stress a manipulative, tactile environment as they did with multiplication. Division (as was multiplication) is a new concept in third grade, and the division learning process must focus on the physical concept first. However, it is extremely beneficial for fourth teachers' instructional ability when students arrive in their classroom's knowing both multiplication and division math facts.

Of course, division in the mathematical form of a 'fact family' is indeed the exact opposite of multiplication; however, again, it does not seem that way to the vast majority of elementary students. Computing a product given both factors is as straightforward as addition with two addends. It is a left to right linear approach. *This situation is not true with division.* In division, there is a missing element and the multiplication product is given – but it is called the dividend in the case of division. ***What is missing from a multiplication standpoint is a factor, and therein lies the solution***.

Multiplication Practice: Find the Missing Factor – Name: _____

4's, 5's and 6's

1 x ___ = 4	5 x ___ = 5	6 x ___ = 12	6 x ___ = 6
4 x ___ = 8	4 x ___ = 24	6 x ___ = 6	6 x ___ = 30
6 x ___ = 12	6 x ___ = 48	4 x ___ = 8	5 x ___ = 30
5 x ___ = 15	4 x ___ = 24	5 x ___ = 40	6 x ___ = 54
6 x ___ = 18	5 x ___ = 30	5 x ___ = 30	6 x ___ = 60
1 x ___ = 6	4 x ___ = 8	1 x ___ = 6	5 x ___ = 55
5 x ___ = 15	5 x ___ = 45	6 x ___ = 12	4 x ___ = 20
4 x ___ = 12	4 x ___ = 8	6 x ___ = 18	5 x ___ = 40

The author created a three-part series called, 'Find the Missing Factor' which is a systematic methodology of computing the quotient (or a divisor) via a multiplication math fact. The three (3) practice sheets reduce the mystery of learning the automaticity of division math facts. The three 'Find the Missing Factor' sheets are separated into missing factors for the following three sets: (1-3), (4-6) and (7-9). *Division is a non-commutative property* like subtraction, *but the 'Find the Missing Factor' methodology turns the process back into a commutative approach to division – at least in the manner that students learn associations of two numbers - factors.*

For instance, 6 x ___ = 42, reinforces the 6 and 7 exchanging or commutative process of the equation's 'factors' but now, for learning the associated division math facts. In short, the student is attempting to locate the missing factor which in the division world is computing a quotient. All three (3) 'Find the Missing Factor' resource

sheets are included at the end of the document. Each of the three assessment sheets should be completed in 5 minutes, and students rapidly complete the Formative Loop math fact case for division. In reality, the combination of the Formative Loop build-up for division math facts and the 'Find the Missing Factor' resource press students to complete division facts as third graders in about two (2) weeks.

> **Note:** It is recommended to challenge students to complete the 'Find the Missing Factor' resource pages, and/or provide them homework on each sheet in conjunction with their Formative Loop build-up process for division math facts.

Math Processing Skills (Formative Loop Numeracy Bonus)

The other numeracy skills in arithmetic other than math facts are math processing skills. Some of those skills are place value, rounding, Making 10, even and odd, estimation, computation skills, fractions, decimals, etc. For this reason, it is highly beneficial for the educator to select the two separate Formative Loop numeracy schemes – one for only the math facts and the other one for math processing skills. In doing so, both numeracy skill sets are learned simultaneously and both are critical to a students' ability to be prepared for embedded numeracy skills in word or story problems.

It is important to realize that Formative Loop is designed as **both a stop-gap and grade level resource.** Thus, the program simultaneously addresses prior grade level numeracy gaps as well as current grade level skill standards. In doing so, students are rapidly pressed back to grade level mathematics without a detailed analysis of missing skills for each student. The Formative Loop numeracy program is designed based on quantile philosophy and Bloom's Taxonomy without the need to solve each student's dependent math skill needs. The corrective actions occur as students' progress through the math fact and math skill processing schemes at their own individual pace rectifying dependent numeracy skill gaps and adding grade level skills both sequentially and simultaneously.

Final Comments on Student Math Facts Mastery – Easy to Do!

Ensuring that math facts and processing skills are mastered by ALL students is not an overly arduous task to accomplish. Of course, a structured and consistent plan as well as educator effort is required. *It is NOT a complicated issue; in fact, it is more of a common-sense problem.* But, it cannot be a passive learning process for students, and educators must have a plan and a predictable structured system. Teachers and administrators must motivate and encourage struggling students during the learning process. This process can't be left for pure chance; it requires effort. However, the benefits to both teacher and students far outweigh the expended energy. It only takes the educators' will and an effective plan to get this numeracy work completed for every child!

There are additional advantages when students master their math facts and processing numeracy skills. First, they will become adept problem solvers which is the goal of every math educator in public education. Without numeracy skills, students become cognitively overwhelmed when attempting to solve a word/story problem either by faltering when they are not able to solve one (or more) of the embedded discrete math skills. Or, if they inefficiently and laboriously solve each embedded math skill while problem solving, children frequently do not possess the stamina to complete multiple word problems on a standardized assessment. Second, students will not be prepared with the prerequisites in algebra, geometry and trigonometry. Since arithmetic skills are the foundation for those three mathematics' areas in middle and high school, students without those skills are not proficient in learning higher order dependent skills. Third, the salaries in lucrative technology

fields require math and science skills; thus, without perquisite public school math skill sets, students' career opportunities in either vocational schools or university will be limited.

As a highly successful urban, Title 1 teacher and campus administrator, I am unable to academically turnaround challenging campuses and eliminate the achievement gap without the prescribed mythologies for numeracy skill development, Formative Loop and a bridge resource (i.e., daily problem-solving resource). The reasons for this thinking are straightforward. Formative Loop allows the principal to implement a schoolwide accountable numeracy program that *targets every student* in real time. Thus, no student slips through the proverbial academic crack. All students are placed in a position to perform academically well at a low-income Title 1 campus. The program's functionality affords that level of monitoring and support for each and every student at the campus, and additional intervention classes can be easily created to account for the remaining students struggling in any one of the four math fact operations.

Additionally, not all elementary educators understand and share the urgency and academic need of student math fact numeracy skill automaticity. However, Formative Loop's functionality affords the campus administrator to implement an *external* global numeracy program as opposed to a classroom teacher handling all the Formative Loop daily numeracy duties in their entirety. Actually, in the nearly three decades of this type of curricular programming, the vast majority of classroom teachers are extremely pleased with this level of numeracy support. Yet, at every campus, there are always several classroom educators that do **not understand and consequently, do not prepare** their students for a fundamental arithmetic math foundation. It has always been unclear to me the reason(s) a handful of teachers and administrators fail to recognize that students' numeracy skill ability is key to problem solving and future mathematical prowess. I find it pointless to speculate on their reasoning since all student data, outcomes or logical rational is all but ignored. What can be stated accurately is that mathematical ignorance has adverse ramifications upon student achievement outcomes as well as limiting the career options many years later when their students are adults. Moreover, if the two (2) five-minute daily assessments are graded and inputted by external classroom personnel in the manner described in this document, the campus administrator is able to dramatically minimize those teachers' negative impact on student achievement, social justice and educational equity at the campus.

Any curricular program is subject to varying constraints of teacher experience. Campus administrators have long recognized that they are unable to consistently employ an entire faculty of seasoned classroom teachers, and pragmatically, they must hire novice and entry-level educators. Academic reformation has long sought that the solution to Title 1 campuses must originate solely from teacher training. Of course, training teachers to be efficacious in the classroom is vitally important, but the training should focus on induction training, effective classroom management, spaced repetition and specific instructional pedagogy development. Similarly, as at Title 1 campuses, high socioeconomic elementary and middle schools are also constantly hiring entry-level teachers, but their academic campus' performance does not appreciably suffer in any given school year. ***Why?*** Affluent campuses are a forgiving academic environment since the mass of their students do not possess significant academic literacy and numeracy gaps. In short, students attending medium to high socioeconomic schools are grade level ready academically, so students are prepared and make mathematical connections regardless if the instruction is delivered via a veteran educator or a first-year teacher.

However, when using Formative Loop's schoolwide numeracy program, the dire **need** for teacher experience is minimized since an entry-level teacher possesses the capacity to produce the same student outcomes as a highly seasoned educator. It is imperative that this point not be missed. *The implementation of this type of numeracy program allows the campus principal to ensure high mathematics performance for every student within one year of implementation – regardless of teacher experience levels.* ***Why?*** The daily numeracy program not only presses math facts and math processing skills, it is designed to simultaneously eradicate prior grade level numeracy gaps. Thus, low-income students are similarly positioned academically as their more affluent peers and are equally capable of forming the logical mathematical connections regardless if the instruction is provided by a novice teacher or a veteran one.

It is equally important to stress that the quality of the teacher's skill development core lesson can be monitored by the students' two assessment results in daily numeracy. Furthermore, the implementation of a problem-solving resource (i.e., bridge resource) also affords the principal the ability to monitor the application process for each student as equally well as each student's numeracy ability. Hence, the classroom teacher is permitted to design their own core lesson that fits their instructional style, but the lesson should focus on skill development since daily numeracy and problem solving are addressed via Formative Loop and a bridge resource. ***Why?*** Because the ***infamous achievement gap is actually a skill gap***! Once the skill gap is eradicated or dramatically reduced, the problem solving resource prepares the student for a grade level assessment as required by each State's mathematics standards.

If the reader is given the impression that the above process is a complicated system to implement, it is not! If this system were complicated or a random process, neither extreme would be effective. Intricate systems and happenstance rarely if ever work; they break down due to too many moving parts or a lack of planning. The system that is successful is ***a highly organized and simple system***. The least moving parts is the most effective and efficient system design in in any professional field. The Formative Loop system greatly limits the number of moving parts. Equally important, since numeracy skills in arithmetic are essential and finite in number, they evolve into a repetitive need each school year. Thus, the numeracy process must be controlled and automated to yield heightened student outcomes. In the engineering field, the following statement is a system philosophy that is applicable to the Formative Loop numeracy programming, "*If a repetitive process exists, it can be automated into a system of 'mechanized' efficacy and efficiency."*

A complicated or random system will not work. Either extreme ultimately fails.

Only an organized and *simple* system can be both efficient and effective.

Continuing, teachers quickly assess students using the two (2) five (5) minute assessments (math fact and math processing skills) each morning in their classrooms; however, again, the two (2) student assessments are checked and inputted by math specialists, volunteers, TAs and/or administrators – external from the classroom. This collaborative work can be completed very quickly with a sound system, and there are viable options for conducting any student intervention work that may be needed based on the students' two (2) – five (5) minute assessments. One efficient methodology is student grouping of skill deficiencies in a classroom or classroom teachers conduct the intervention – as needed. Since the student is retested on that math processing skill the following day to verify mastery, the grader knows immediately if the interventions were completed as required.

I would be remiss if I failed to mention that some educators provide the SAME 100 mixed fact sheets over and over to a child after the child fails to demonstrate appreciably improve. This practice has befuddled me for decades. The educator has not realized that the 100 mixed facts are too much for the intermediate student, and the task needs to be broken down to manageable segments for them. Hence, the Formative Loop build-up math fact program. This simple process eliminates the anxiety that some students feel on these types of timed tasks. The key is not to relent to their anxiety because the educator did not adapt and redesign student learning, pragmatically, a viable sequencing to ensure student success. The author worked with elementary students to for almost three (3) decades in all core elementary subjects. As either a classroom teacher or campus administrator, I have never had an issue with a student feeling overwhelmed. I broke the task into manageable steps and learning for my students as does Formative Loop's math fact build-up program. It handles this process automatically and each student is pressed on specific strategies outlined in this document that are personally effective for them.

Finally, when I was a Title 1 elementary principal, I would engage at least one hour to one and a half hours per day – ***everyday***, checking and inputting third (3^{rd}) grade students Formative Loop's numeracy assessments. I engage in this time since I knew it was a critical step in student achievement results – eradicating the numeracy gap of prior skills and ensuring grade level numeracy. When those third-grade students matriculated to the fourth and fifth grades, the mass of those students were on grade level and readily passed math fact assessments and daily processing skills. At that point, those students were at the independent stage of learning. I continued to focus my time and energy on third grade daily numeracy as well as addressing deficient numeracy skills from any newly enrolled 4^{th} and 5^{th} grade students at my school. Many of the newcomers to 4^{th} and 5^{th} grades struggled with math fact and processing skills because they had been conveniently ignored at their previous elementary campus.

Using the methods described in this document, multiple National Blue Ribbon Schools and National Blue Ribbon Profile Schools have been produced. The results at these urban, Title 1 elementary schools matched the student outcomes of the highest socioeconomic status elementary schools in the country. With a plan, focus, commitment, consistency, motivation, educational equity is not only possible, it is a replicable process at any socioeconomic elementary or middle school.

Appendix

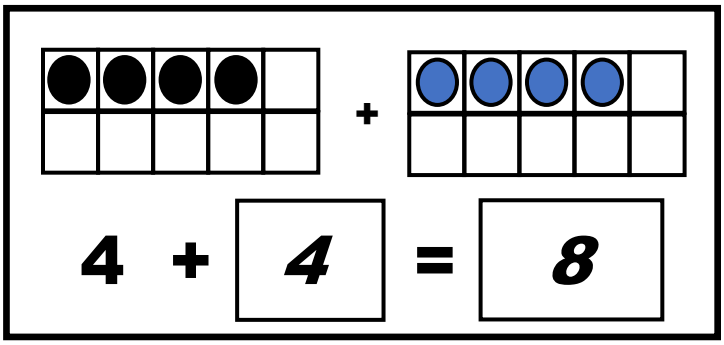
Table of Contents

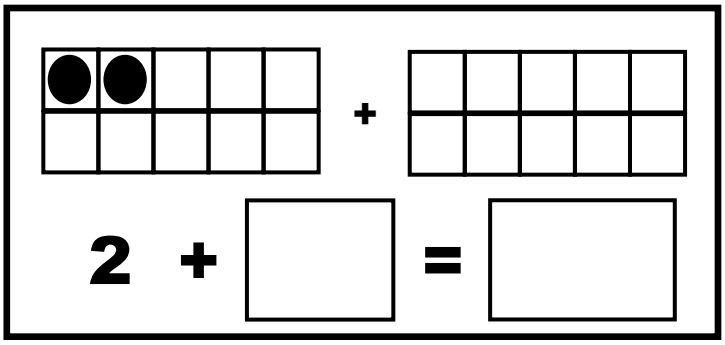
Listing of Numeracy Resources

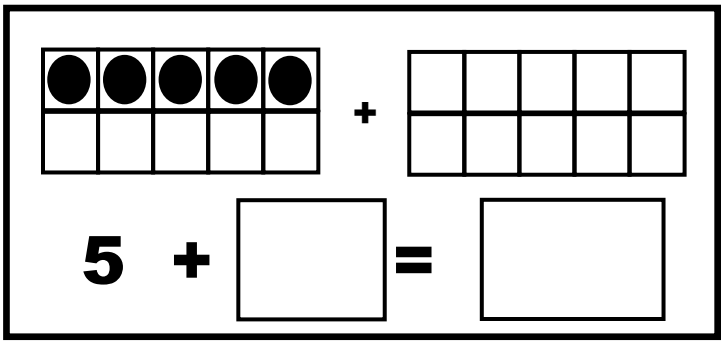
Resource Name	Applicable Grade Level	Recommended Timed Allotment	Page(s)
Doubles Pictorial Representation	1st and 2nd	None	A1 – A4
Doubles – Addition	3rd and 6th	5 minutes	A5 – A8
Doubles Plus 1 Pictorial Representation	1st and 2nd	None	A9 – A12
Doubles Plus 1 – Addition	3rd and 6th	5 minutes	A13 – A16
Making 10 – Pictorial Representation	1st and 2nd	None	A17 – A20
Making 10 – Number Sentences	1st and 2nd	None	A21 – A24
Making 10 – Mental Math	1st	2 minutes 30 seconds	A25 – A28
Making 10 – Mental Math	2nd	2 minutes 30 seconds	A29 – A32
Making 10 – Mental Math	3rd – 6th	5 minutes	A33 – A34
Multiples - 1	3rd – 6th	5 minutes	A35 – A36
Multiples – 1 Two Practice Sheets per Page	3rd – 6th	Homework and In-Class Practice	A37
Multiples – 1 Four Practice Sheets per Page	3rd – 6th	Homework and In-Class Practice	A38
Perfect Square Multiplication Practice	3rd – 6th	5 minutes	A39 – A42
Find the Missing Factor	3rd – 6th	5 minutes	A43 – A48

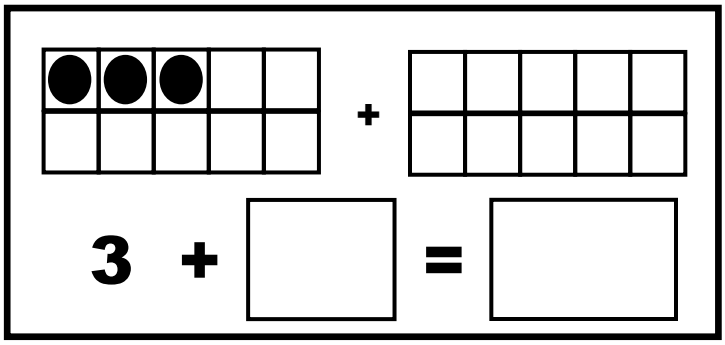
DOUBLES

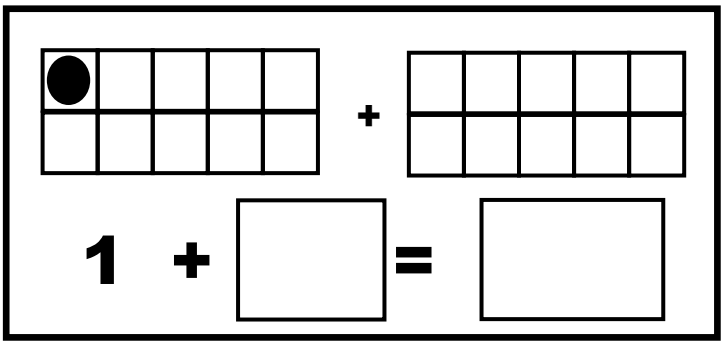
Directions: **Place circles in the correct number of boxes. rrectly complete the number sentence and find the Doubles' SUM.**

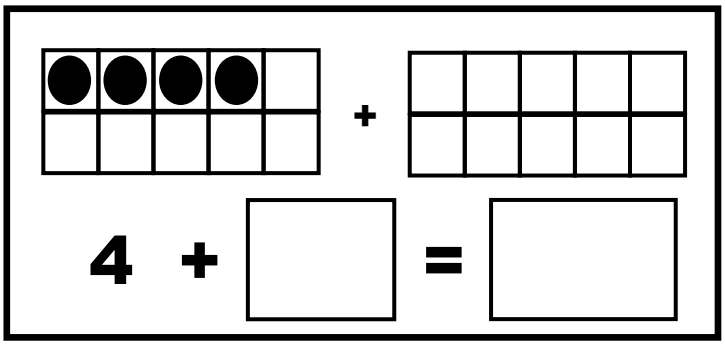


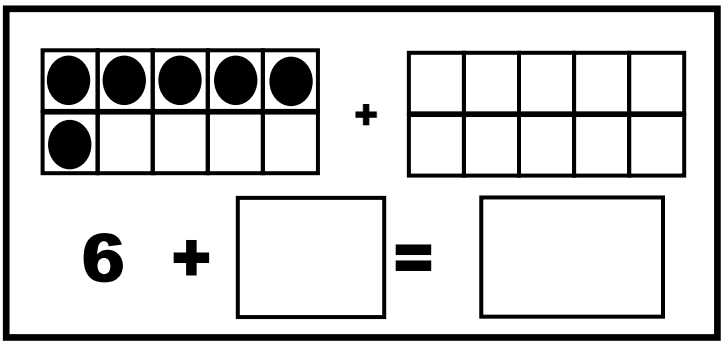


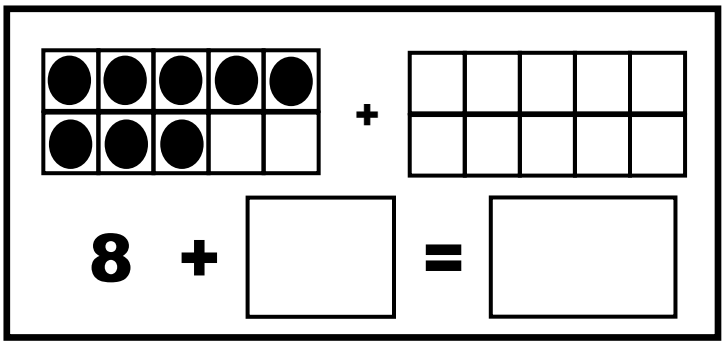


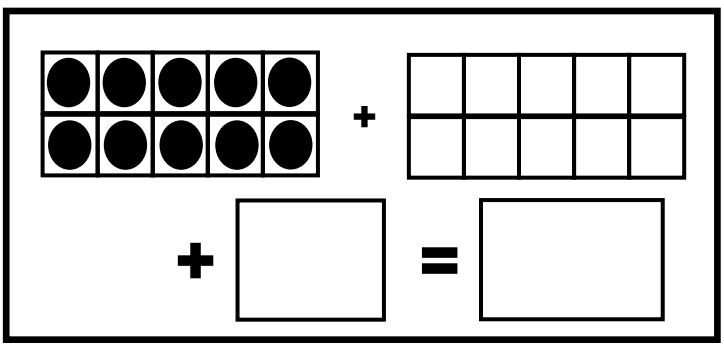


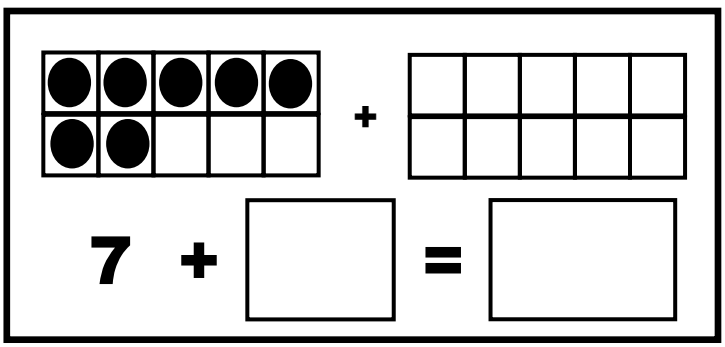






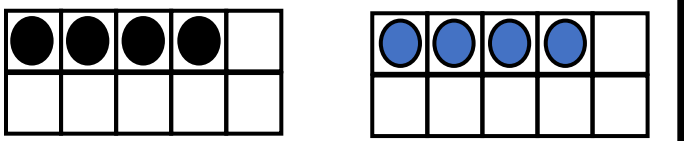






D LES

Directions: Place circles in the correct number of boxes. rrectly complete the number senten a find the Doubles' SUM.



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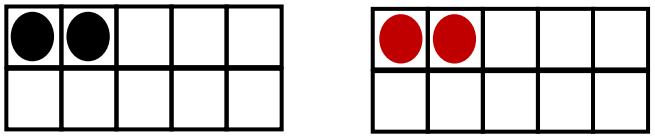

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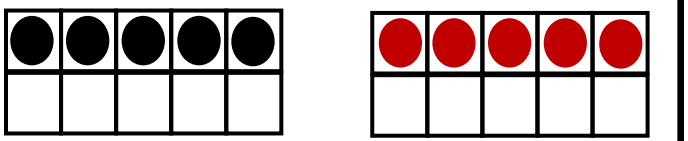

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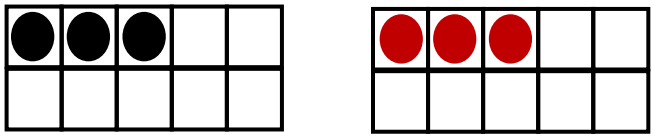

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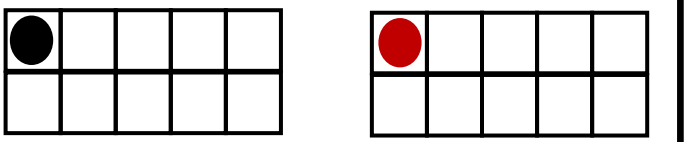

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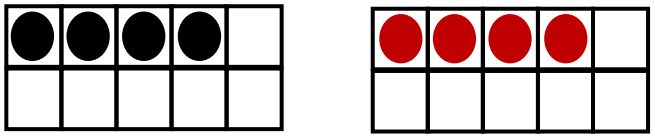

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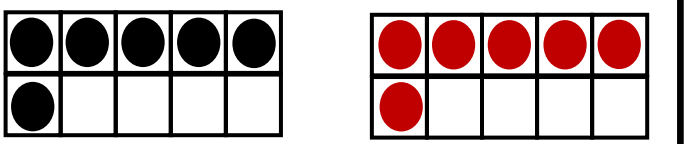

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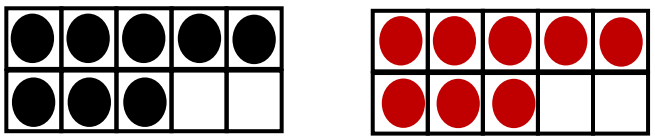

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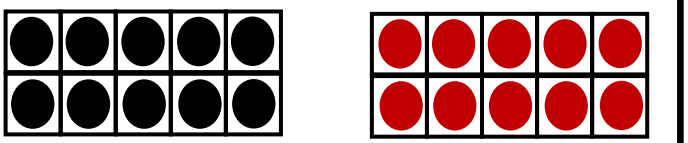

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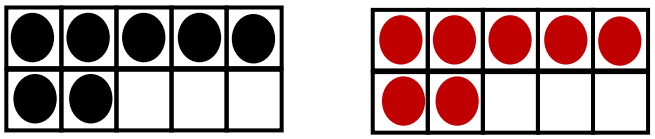

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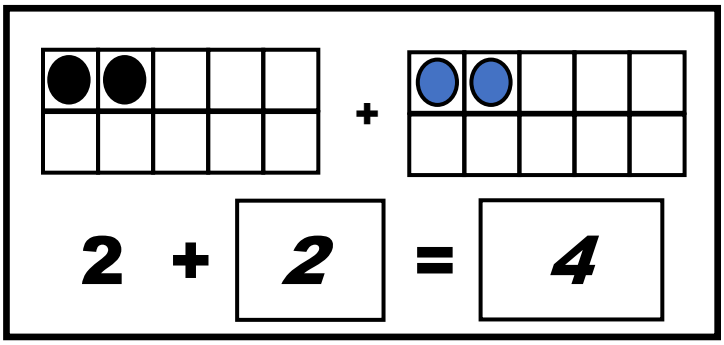
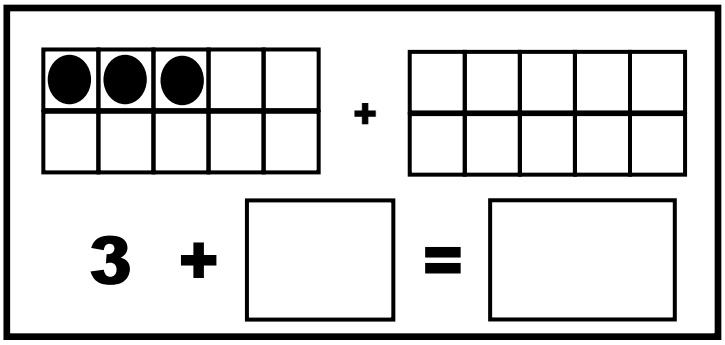
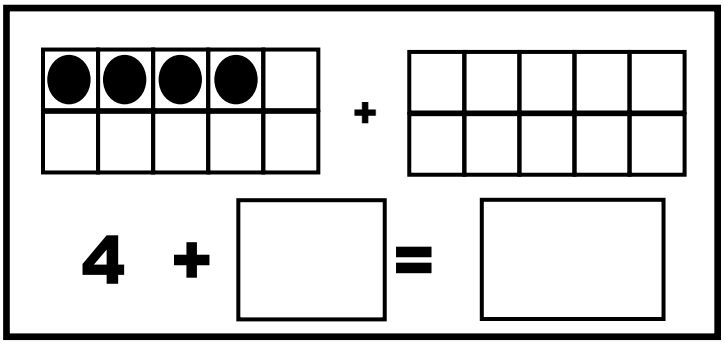
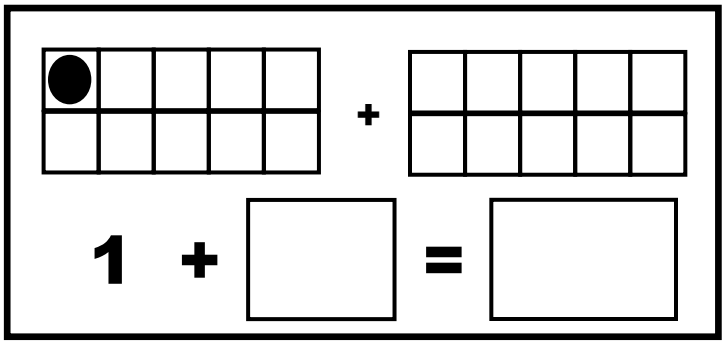
DOUBLES

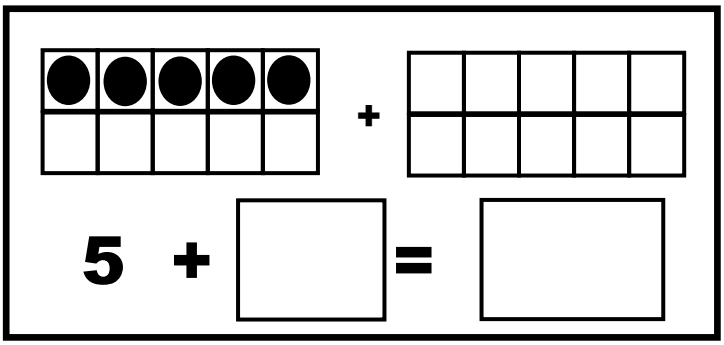
Directions: Place circles in the correct number of boxes. rrectly complete the number sentence and find the Doubles' SUM.

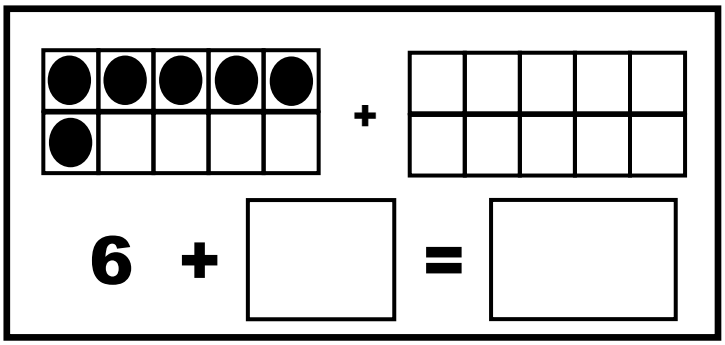


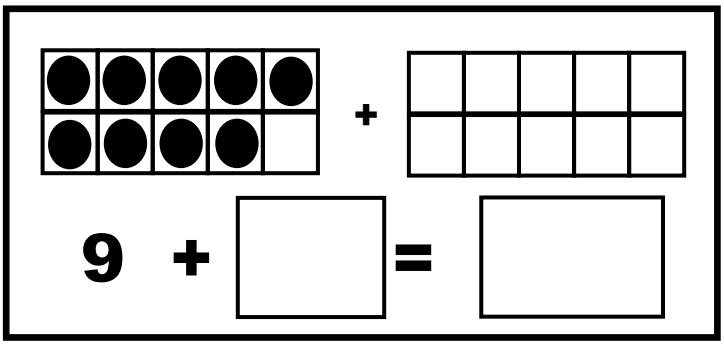


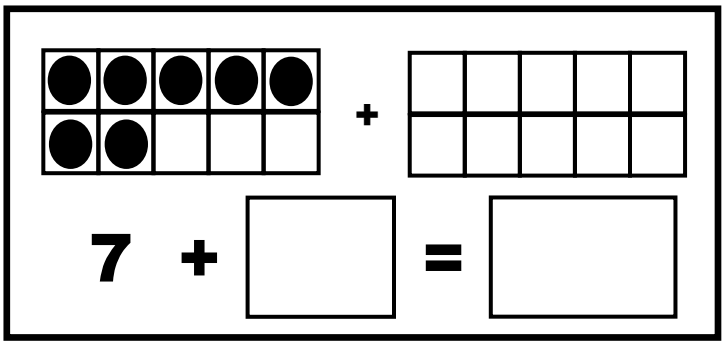


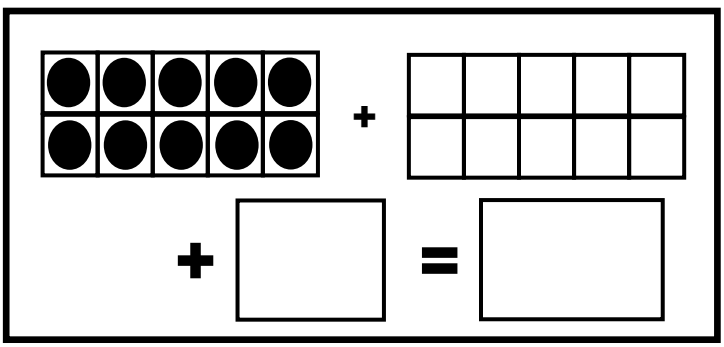


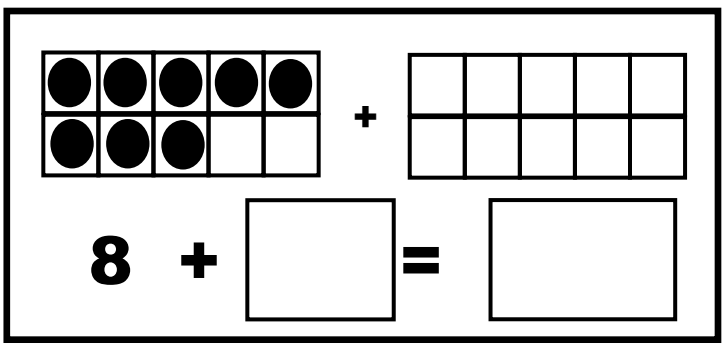












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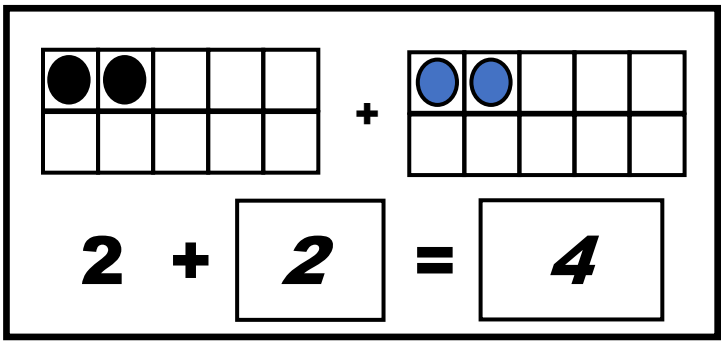
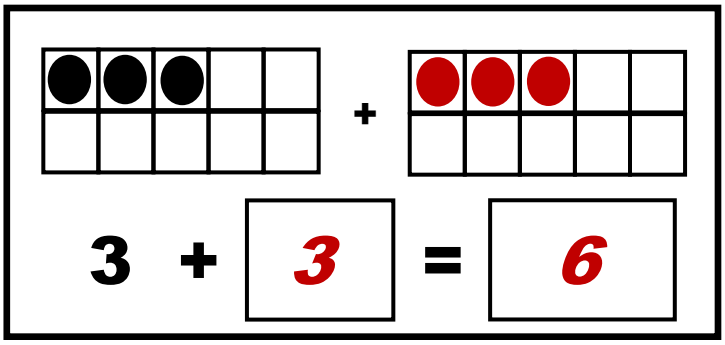
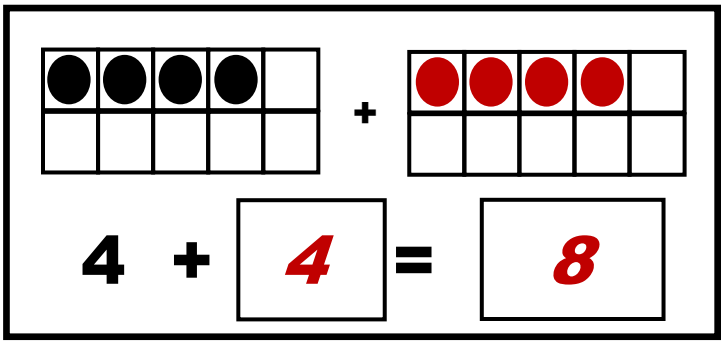
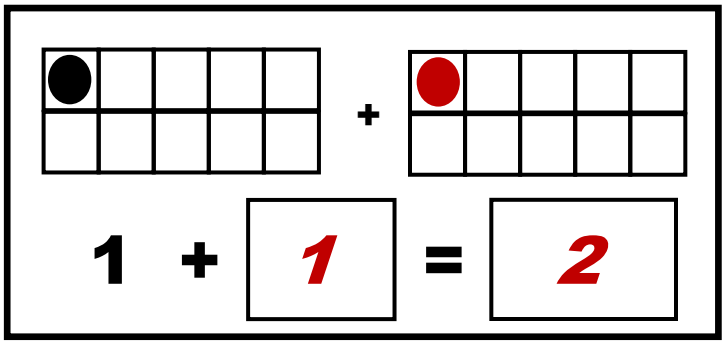
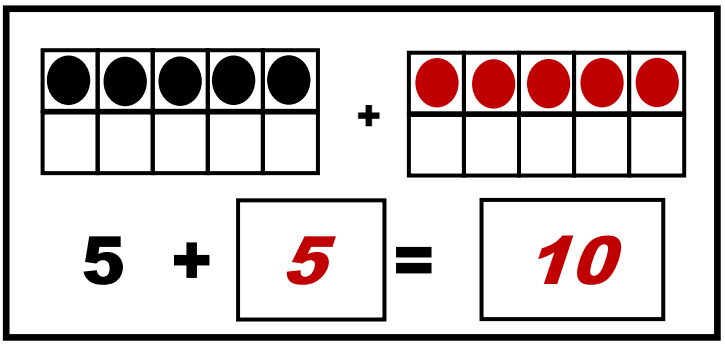
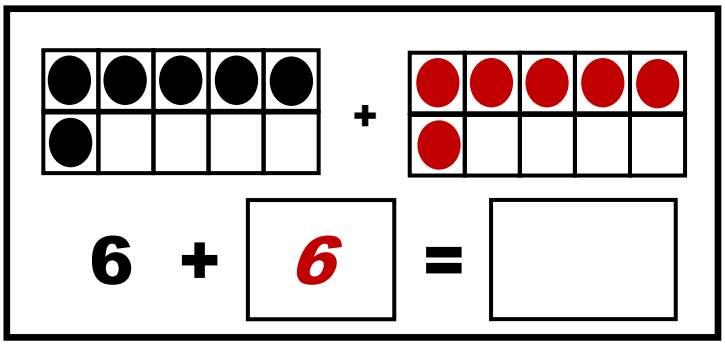


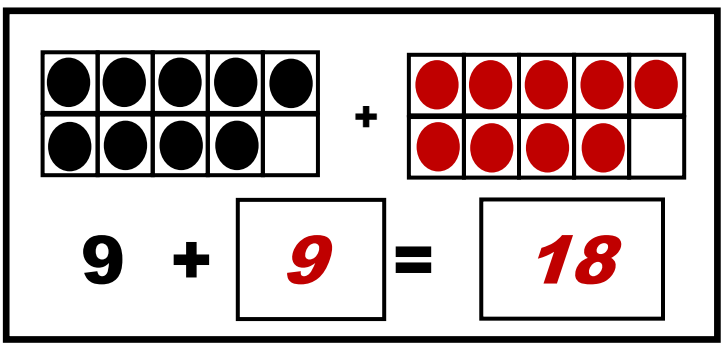


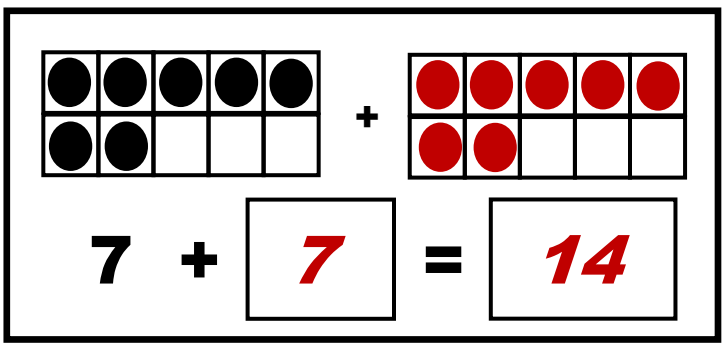


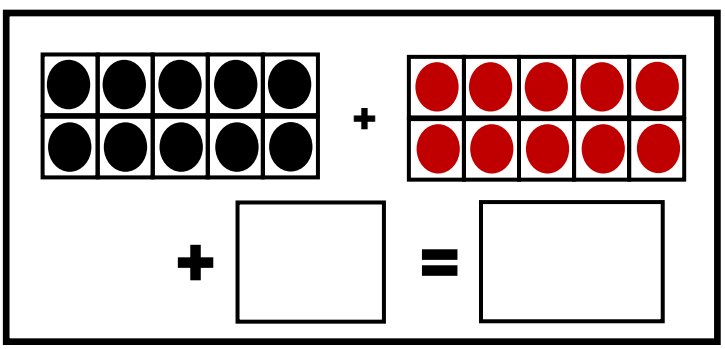


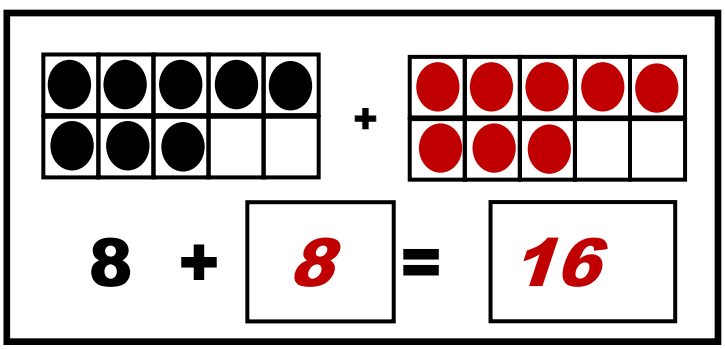












3rd – 8th Grade Doubles – Math Fact Practice – Version 1

Directions: **Add and find each sum (DOUBLES). Use another sheet of paper to cover the above row after it has been completed. Complete as many of the doubles below in 5 minutes. Good Luck!!!**

6	2	3	9	1	10	8	5	7	4
+ 6	+ 2	+ 3	+ 9	+ 1	+ 10	+ 8	+ 5	+ 7	+ 4
5	3	4	6	2	10	7	9	8	1
+ 5	+ 3	+ 4	+ 6	+ 2	+ 10	+ 7	+ 9	+ 8	+ 1
9	1	3	8	7	4	2	6	10	5
+ 9	+ 1	+ 3	+ 8	+ 7	+ 4	+ 2	+ 6	+ 10	+ 5
1	4	5	10	3	9	8	6	7	2
+ 1	+ 4	+ 5	+ 10	+ 3	+ 9	+ 8	+ 6	+ 7	+ 2
8	2	3	9	1	7	6	10	5	4
+ 8	+ 2	+ 3	+ 9	+ 1	+ 7	+ 6	+ 10	+ 5	+ 4
6	3	4	9	5	2	8	7	10	1
+ 6	+ 3	+ 4	+ 9	+ 5	+ 2	+ 8	+ 7	+ 10	+ 1
2	10	8	9	5	6	1	3	7	4
+ 2	+ 10	+ 8	+ 9	+ 5	+ 6	+ 1	+ 3	+ 7	+ 4
7	1	6	2	4	9	8	5	10	3
+ 7	+ 1	+ 6	+ 2	+ 4	+ 9	+ 8	+ 5	+ 10	+ 3
2	7	10	3	1	5	4	9	8	6
+ 2	+ 7	+ 10	+ 3	+ 1	+ 5	+ 4	+ 9	+ 8	+ 6
1	4	6	8	2	10	3	9	7	5
+ 1	+ 4	+ 6	+ 8	+ 2	+ 10	+ 3	+ 9	+ 7	+ 5

3rd – 8th Grade Doubles – Math Fact Practice – Version 1

Directions: **Add and find each sum (DOUBLES). Use another sheet of paper to cover the above row after it has been completed. Complete as many of the doubles below in 5 minutes. Good Luck!!!**

6	+ 6	12	2	+ 2	4	3	+ 3	6	9	+ 9	18	1	+ 1	2	
10	+ 10	20	8	+ 8	16	5	+ 5	10	7	+ 7	14	4	+ 4	8	
5	+ 5	10	3	+ 3	6	4	+ 4	8	6	+ 6	12	2	+ 2	4	
10	+ 10	20	7	+ 7	14	9	+ 9	18	8	+ 8	16	1	+ 1	2	
9	+ 9	18	1	+ 1	2	3	+ 3	6	8	+ 8	16	7	+ 7	14	
4	+ 4	8	2	+ 2	4	6	+ 6	12	10	+ 10	20	5	+ 5	10	
1	+ 1	2	4	+ 4	8	5	+ 5	10	10	+ 10	20	3	+ 3	6	
9	+ 9	18	8	+ 8	16	6	+ 6	12	7	+ 7	14	2	+ 2	4	
8	+ 8	16	2	+ 2	4	3	+ 3	6	9	+ 9	18	1	+ 1	2	
7	+ 7	14	6	+ 6	12	10	+ 10	20	5	+ 5	10	4	+ 4	8	
6	+ 6	12	3	+ 3	6	4	+ 4	8	9	+ 9	18	5	+ 5	10	
2	+ 2	4	8	+ 8	16	7	+ 7	14	10	+ 10	20	1	+ 1	2	
2	+ 2	4	10	+ 10	20	8	+ 8	16	9	+ 9	18	5	+ 5	10	
6	+ 6	12	1	+ 1	2	3	+ 3	6	7	+ 7	14	4	+ 4	8	
7	+ 7	14	1	+ 1	2	6	+ 6	12	2	+ 2	4	4	+ 4	8	
9	+ 9	18	8	+ 8	16	5	+ 5	10	10	+ 10	20	3	+ 3	6	
2	+ 2	4	7	+ 7	14	10	+ 10	20	3	+ 3	6	1	+ 1	2	
5	+ 5	10	4	+ 4	8	9	+ 9	18	8	+ 8	16	6	+ 6	12	
1	+ 1	2	4	+ 4	8	6	+ 6	12	8	+ 8	16	2	+ 2	4 ★	
10	+ 10	20	3	+ 3	6	9	+ 9	18	7	+ 7	14	5	+ 5	10	

3rd – 8th Grade Doubles – Math Fact Practice – Version 2

Directions: **Add and find each sum (DOUBLES). Use another sheet of paper to cover the above row after it has been completed. Complete as many of the doubles below in 5 minutes. Good Luck!!!**

1	4	6	8	2	10	3	9	7	5
+ 1	+ 4	+ 6	+ 8	+ 2	+ 10	+ 3	+ 9	+ 7	+ 5
2	7	10	3	1	5	4	9	8	6
+ 2	+ 7	+ 10	+ 3	+ 1	+ 5	+ 4	+ 9	+ 8	+ 6
7	1	6	2	4	9	8	5	10	3
+ 7	+ 1	+ 6	+ 2	+ 4	+ 9	+ 8	+ 5	+ 10	+ 3
2	10	8	9	5	6	1	3	7	4
+ 2	+ 10	+ 8	+ 9	+ 5	+ 6	+ 1	+ 3	+ 7	+ 4
6	3	4	9	5	2	8	7	10	1
+ 6	+ 3	+ 4	+ 9	+ 5	+ 2	+ 8	+ 7	+ 10	+ 1
6	2	3	9	1	10	8	5	7	4
+ 6	+ 2	+ 3	+ 9	+ 1	+ 10	+ 8	+ 5	+ 7	+ 4
5	3	4	6	2	10	7	9	8	1
+ 5	+ 3	+ 4	+ 6	+ 2	+ 10	+ 7	+ 9	+ 8	+ 1
9	1	3	8	7	4	2	6	10	5
+ 9	+ 1	+ 3	+ 8	+ 7	+ 4	+ 2	+ 6	+ 10	+ 5
1	4	5	10	3	9	8	6	7	2
+ 1	+ 4	+ 5	+ 10	+ 3	+ 9	+ 8	+ 6	+ 7	+ 2
8	2	3	9	1	7	6	10	5	4
+ 8	+ 2	+ 3	+ 9	+ 1	+ 7	+ 6	+ 10	+ 5	+ 4

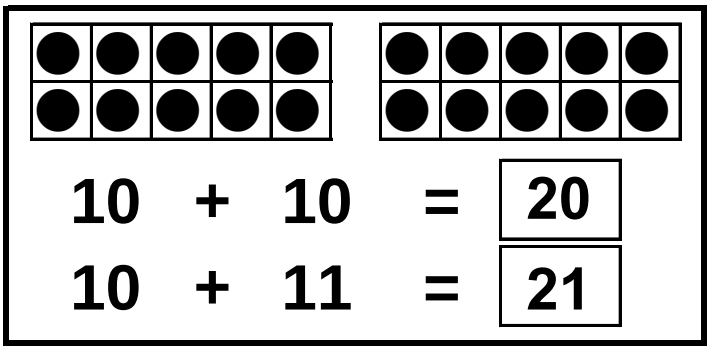
3rd – 8th Grade Doubles – Math Fact Practice – Version 2

Directions: **Add and find each sum (DOUBLES). Use another sheet of paper to cover the above row after it has been completed. Complete as many of the doubles below in 5 minutes. Good Luck!!!**

1	4	6	8	2	10	3	9	7	5
+ 1	+ 4	+ 6	+ 8	+ 2	+ 10	+ 3	+ 9	+ 7	+ 5
2	**8**	**12**	**16**	**4**	**20**	**6**	**18**	**14**	**10**
2	7	10	3	1	5	4	9	8	6
+ 2	+ 7	+ 10	+ 3	+ 1	+ 5	+ 4	+ 9	+ 8	+ 6
4	**14**	**20**	**6**	**2**	**10**	**8**	**18**	**16**	**12**
7	1	6	2	4	9	8	5	10	3
+ 7	+ 1	+ 6	+ 2	+ 4	+ 9	+ 8	+ 5	+ 10	+ 3
14	**2**	**12**	**4**	**8**	**18**	**16**	**10**	**20**	**6**
2	10	8	9	5	6	1	3	7	4
+ 2	+ 10	+ 8	+ 9	+ 5	+ 6	+ 1	+ 3	+ 7	+ 4
4	**20**	**16**	**18**	**10**	**12**	**2**	**6**	**14**	**8**
6	3	4	9	5	2	8	7	10	1
+ 6	+ 3	+ 4	+ 9	+ 5	+ 2	+ 8	+ 7	+ 10	+ 1
12	**6**	**8**	**18**	**10**	**4**	**16**	**14**	**20**	**2**
6	2	3	9	1	10	8	5	7	4
+ 6	+ 2	+ 3	+ 9	+ 1	+ 10	+ 8	+ 5	+ 7	+ 4
12	**4**	**6**	**18**	**2**	**20**	**16**	**10**	**14**	**8**
5	3	4	6	2	10	7	9	8	1
+ 5	+ 3	+ 4	+ 6	+ 2	+ 10	+ 7	+ 9	+ 8	+ 1
10	**6**	**8**	**12**	**4**	**20**	**14**	**18**	**16**	**2**
9	1	3	8	7	4	2	6	10	5
+ 9	+ 1	+ 3	+ 8	+ 7	+ 4	+ 2	+ 6	+ 10	+ 5
18	**2**	**6**	**16**	**14**	**8**	**4**	**12**	**20**	**10**
1	4	5	10	3	9	8	6	7	2
+ 1	+ 4	+ 5	+ 10	+ 3	+ 9	+ 8	+ 6	+ 7	+ 2
2	**8**	**10**	**20**	**6**	**18**	**16**	**12**	**14**	**4**
8	2	3	9	1	7	6	10	5	4
+ 8	+ 2	+ 3	+ 9	+ 1	+ 7	+ 6	+ 10	+ 5	+ 4
16	**4**	**6**	**18**	**2** ★	**14**	**12**	**20**	**10**	**8**

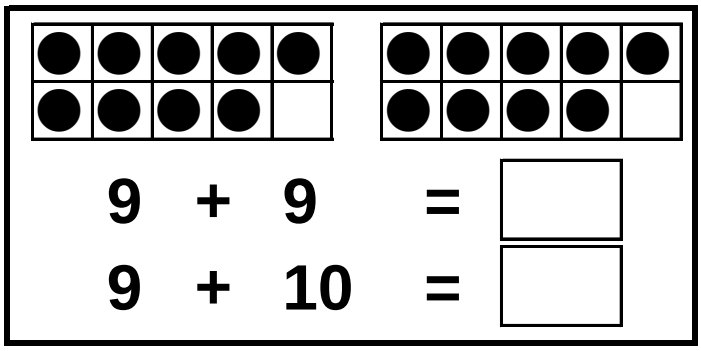
Doubles Plus One

Use Doubles to Learn a new Math Fact by Adding 1 More.



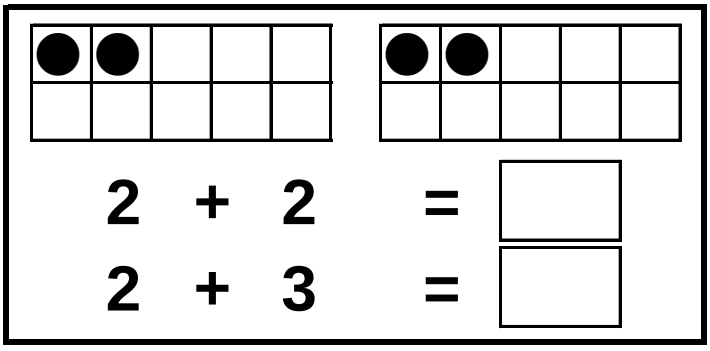
10 + 10 = 20

10 + 11 = 21



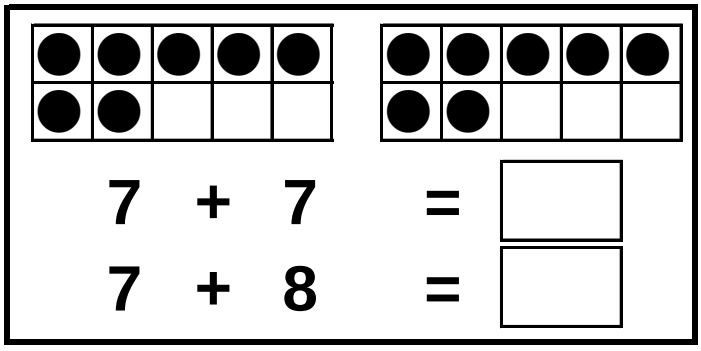
9 + 9 =

9 + 10 =



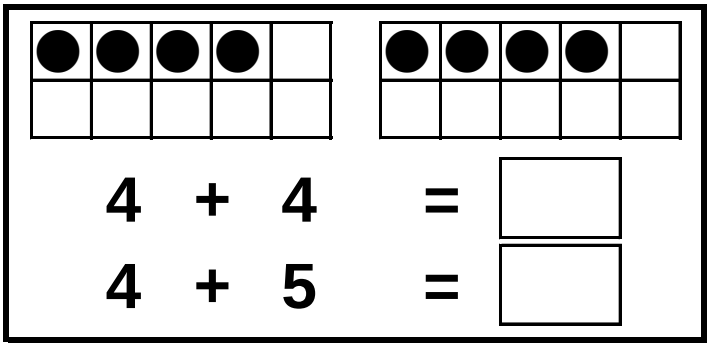
2 + 2 =

2 + 3 =



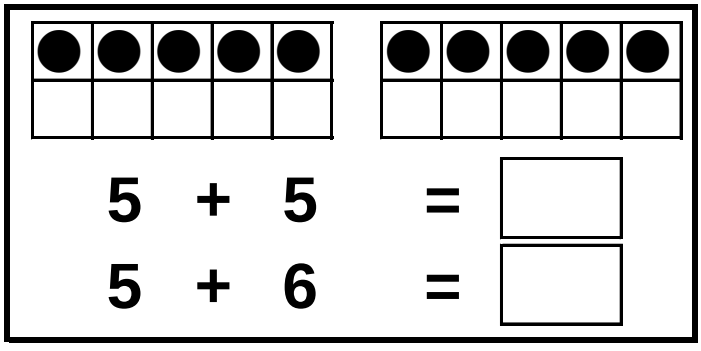
7 + 7 =

7 + 8 =



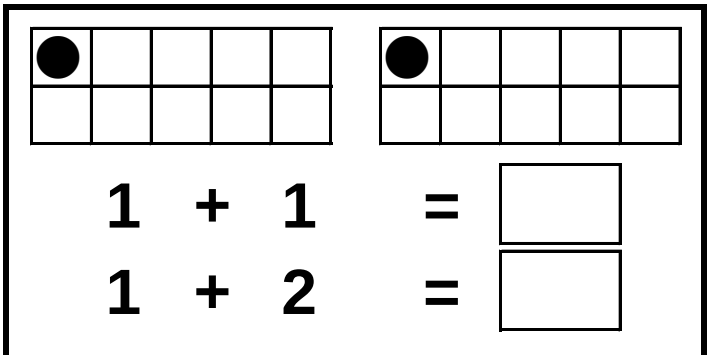
4 + 4 =

4 + 5 =



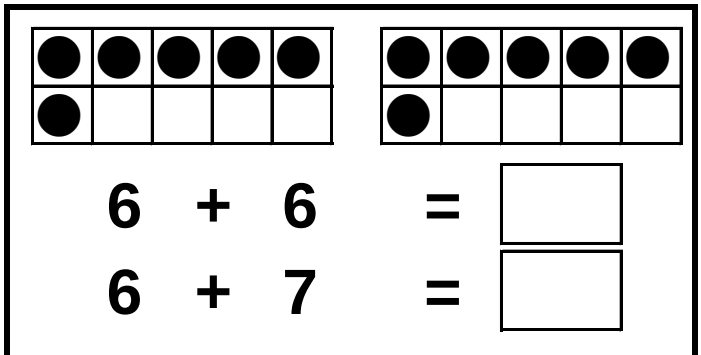
5 + 5 =

5 + 6 =



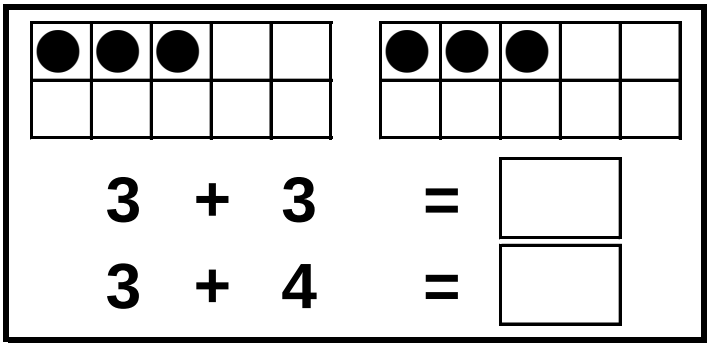
1 + 1 =

1 + 2 =



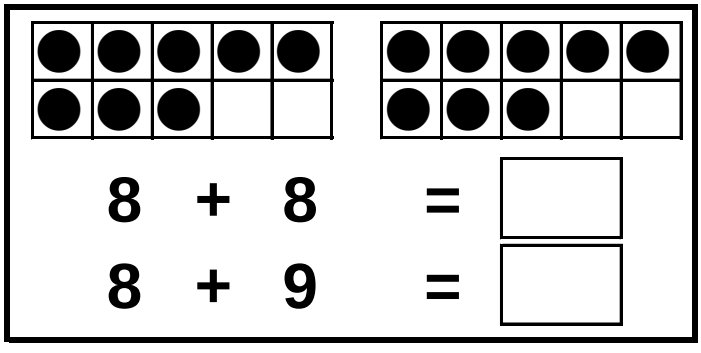
6 + 6 =

6 + 7 =



3 + 3 =

3 + 4 =

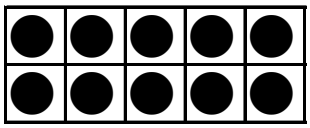


8 + 8 =

8 + 9 =

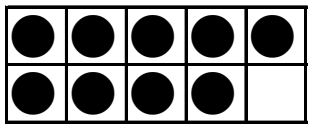
Doubles Plus One

Use Doubles to Learn a new Math Fact by Adding 1 More.



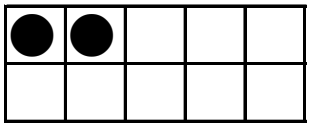
10 + 10 = 20

10 + 11 = 21



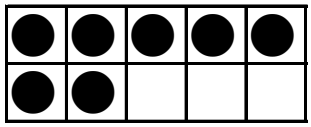
9 + 9 = 18

9 + 10 = 19



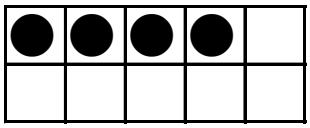
2 + 2 = 4

2 + 3 = 5



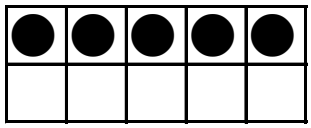
7 + 7 = 14

7 + 8 = 15



4 + 4 = 8

4 + 5 = 9

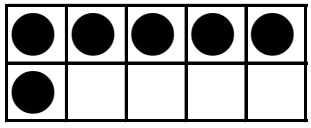


5 + 5 = 10

5 + 6 = 11

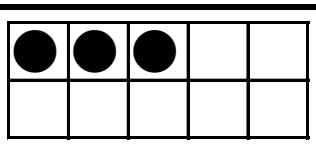
1 + 1 = 2

1 + 2 = 3



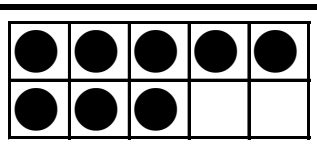
6 + 6 = 12

6 + 7 = 13



3 + 3 = 6

3 + 4 = 7

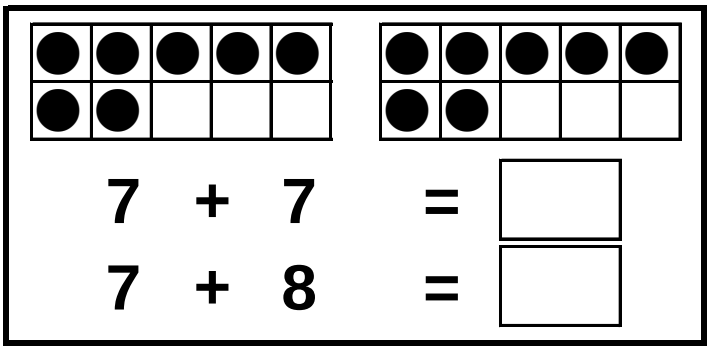


8 + 8 = 16

8 + 9 = 17

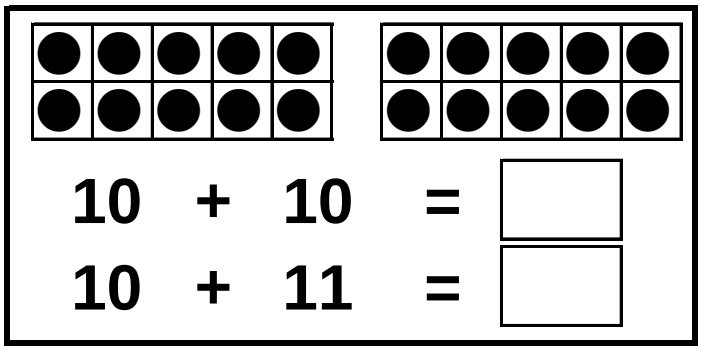
Doubles Plus One

Use Doubles to Learn a new Math Fact by Adding 1 More.



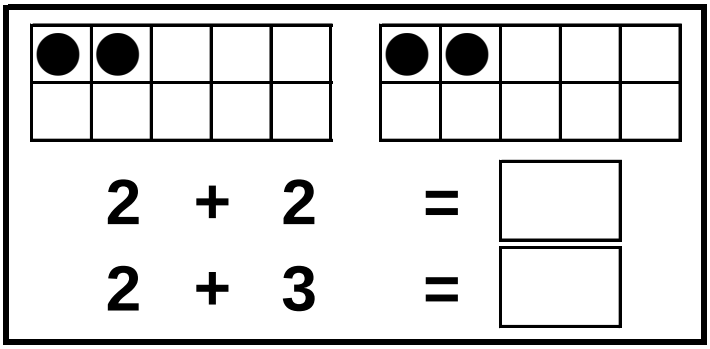
7 + 7 =

7 + 8 =



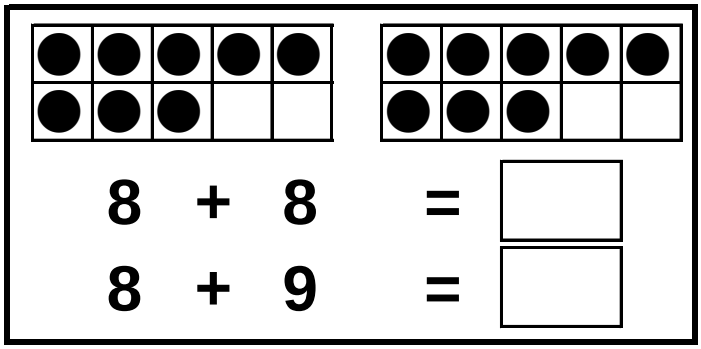
10 + 10 =

10 + 11 =



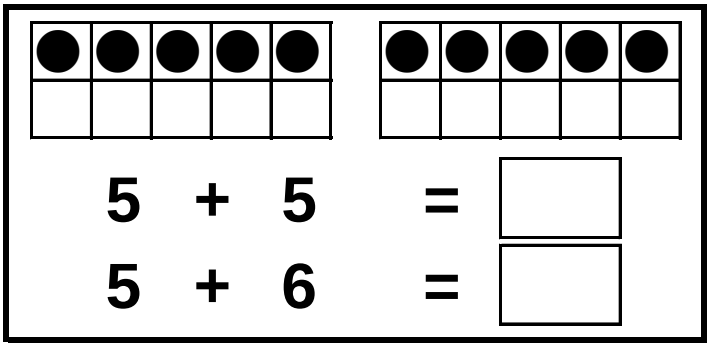
2 + 2 =

2 + 3 =



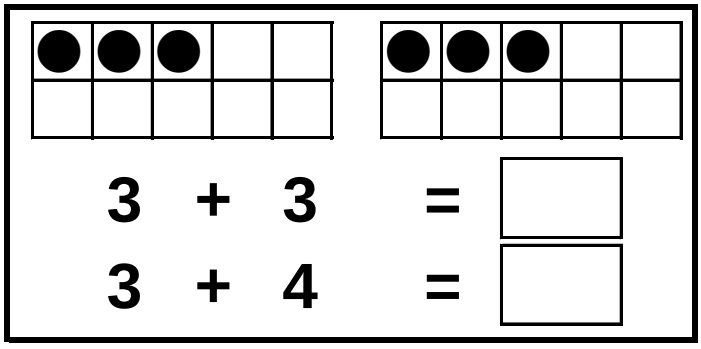
8 + 8 =

8 + 9 =



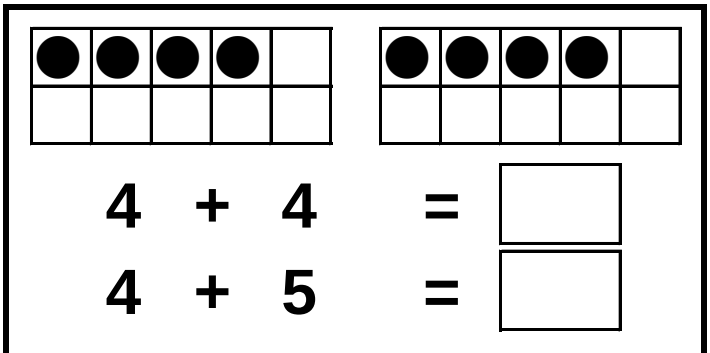
5 + 5 =

5 + 6 =



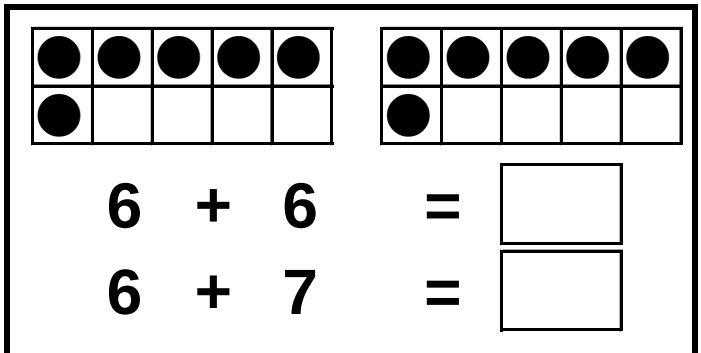
3 + 3 =

3 + 4 =



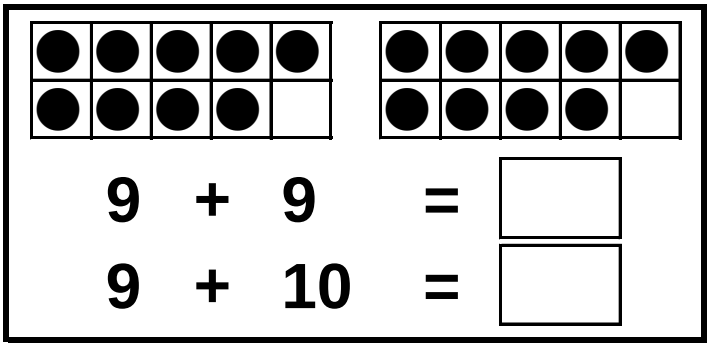
4 + 4 =

4 + 5 =



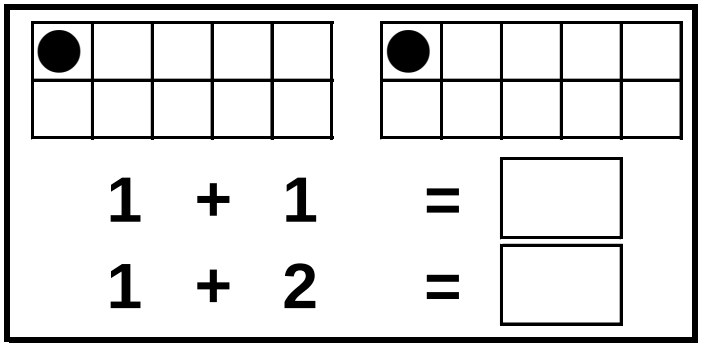
6 + 6 =

6 + 7 =



9 + 9 =

9 + 10 =

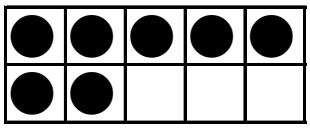


1 + 1 =

1 + 2 =

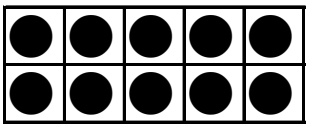
Doubles Plus One

Use Doubles to Learn a new Math Fact by Adding 1 More.



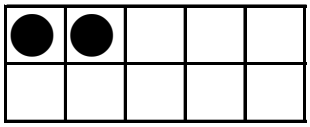
7 + 7 = 14

7 + 8 = 15



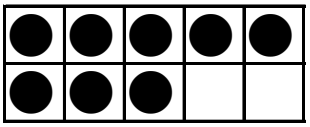
10 + 10 = 20

10 + 11 = 21



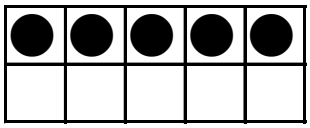
2 + 2 = 4

2 + 3 = 5



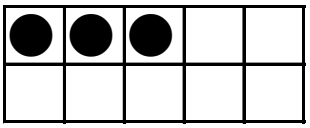
8 + 8 = 16

8 + 9 = 17



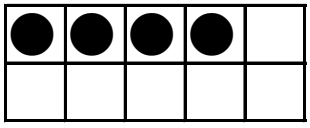
5 + 5 = 10

5 + 6 = 11



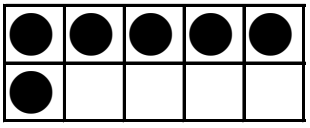
3 + 3 = 6

3 + 4 = 7



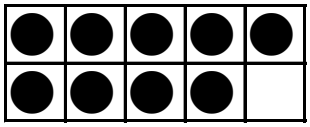
4 + 4 = 8

4 + 5 = 9



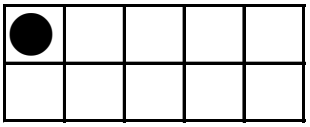
6 + 6 = 12

6 + 7 = 13



9 + 9 = 18

9 + 10 = 19



1 + 1 = 2

1 + 2 = 3

3rd – 8th Grade Doubles Plus 1 – Math Fact Practice – Version 1

Directions: **Double the *SMALLER* addend *and add 1* to find each sum (DOUBLES PLUS 1). Use Another sheet of paper to cover the above row after it has been completed. In 5 minutes, complete as many as you can. Good Luck!!!**

6 + 7	2 + 3	4 + 3	10 + 9	1 + 2	10 + 11	9 + 8	5 + 6	8 + 7	4 + 5
5 + 6	4 + 3	4 + 5	6 + 7	2 + 3	11 + 10	7 + 8	10 + 9	8 + 9	2 + 1
9 + 10	1 + 2	4 + 3	8 + 9	8 + 7	4 + 5	3 + 2	6 + 7	11 + 10	6 + 5
1 + 2	5 + 4	5 + 6	11 + 10	4 + 3	10 + 9	8 + 9	7 + 6	7 + 8	3 + 2
8 + 9	3 + 2	4 + 3	9 + 10	2 + 1	8 + 7	6 + 7	10 + 11	5 + 6	5 + 4
6 + 7	4 + 3	5 + 4	9 + 10	6 + 5	2 + 3	9 + 8	7 + 8	11 + 10	2 + 1
3 + 2	10 + 11	8 + 9	10 + 9	6 + 5	6 + 7	2 + 1	4 + 3	7 + 8	5 + 4
8 + 7	1 + 2	6 + 7	2 + 3	4 + 5	10 + 9	8 + 9	6 + 5	11 + 10	4 + 3
3 + 2	7 + 8	10 + 11	3 + 4	2 + 1	5 + 6	5 + 4	10 + 9	8 + 9	6 + 7
2 + 1	4 + 5	7 + 6	8 + 9	3 + 2	10 + 11	4 + 3	9 + 10	7 + 8	6 + 5

3rd – 8th Grade Doubles Plus 1 – Math Fact Practice – Version 1

Directions: **Double the *SMALLER* addend *and add 1* to find each sum (DOUBLES PLUS 1). Use Another sheet of paper to cover the above row after it has been completed. In 5 minutes, complete as many as you can. Good Luck!!!**

6 + 7 = 13	2 + 3 = 5	4 + 3 = 7	10 + 9 = 19	1 + 2 = 3	10 + 11 = 21	9 + 8 = 17	5 + 6 = 11	8 + 7 = 15	4 + 5 = 9
5 + 6 = 11	4 + 3 = 7	4 + 5 = 9	6 + 7 = 13	2 + 3 = 5	11 + 10 = 21	7 + 8 = 15	10 + 9 = 19	8 + 9 = 17	2 + 1 = 3
9 + 10 = 19	1 + 2 = 3	4 + 3 = 7	8 + 9 = 17	8 + 7 = 15	4 + 5 = 9	3 + 2 = 5	6 + 7 = 13	11 + 10 = 21	6 + 5 = 11
1 + 2 = 3	5 + 4 = 9	5 + 6 = 11	11 + 10 = 21	4 + 3 = 7	10 + 9 = 19	8 + 9 = 17	7 + 6 = 13	7 + 8 = 15	3 + 2 = 5
8 + 9 = 17	3 + 2 = 5	4 + 3 = 7	9 + 10 = 19	2 + 1 = 3	8 + 7 = 15	6 + 7 = 13	10 + 11 = 21	5 + 6 = 11	5 + 4 = 9
6 + 7 = 13	4 + 3 = 7	5 + 4 = 9	9 + 10 = 19	6 + 5 = 11	2 + 3 = 5	9 + 8 = 17	7 + 8 = 15	11 + 10 = 21	2 + 1 = 3
3 + 2 = 5	10 + 11 = 21	8 + 9 = 17	10 + 9 = 19	6 + 5 = 11	6 + 7 = 13	2 + 1 = 3	4 + 3 = 7	7 + 8 = 15	5 + 4 = 9
8 + 7 = 15	1 + 2 = 3	6 + 7 = 13	2 + 3 = 5	4 + 5 = 9	10 + 9 = 19	8 + 9 = 17	6 + 5 = 11	11 + 10 = 21	4 + 3 = 7
3 + 2 = 5	7 + 8 = 15	10 + 11 = 21	3 + 4 = 7	2 + 1 = 3	5 + 6 = 11	5 + 4 = 9	10 + 9 = 19	8 + 9 = 17	6 + 7 = 13
2 + 1 = 3	4 + 5 = 9	7 + 6 = 13	8 + 9 = 17	3 + 2 = 5	10 + 11 = 21	4 + 3 = 7	9 + 10 = 19	7 + 8 = 15	6 + 5 = 11

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3rd – 8th Grade Doubles Plus 1 – Math Fact Practice – Version 2

Directions: **Double the *SMALLER* addend *and add 1* to find each sum (DOUBLES PLUS 1). Use Another sheet of paper to cover the above row after it has been completed. In 5 minutes, complete as many as you can. Good Luck!!!**

2	4	7	8	3	10	4	9	7	6
+ 1	+ 5	+ 6	+ 9	+ 2	+ 11	+ 3	+ 10	+ 8	+ 5
3	7	10	3	2	5	5	10	8	6
+ 2	+ 8	+ 11	+ 4	+ 1	+ 6	+ 4	+ 9	+ 9	+ 7
8	1	6	2	4	10	8	6	11	4
+ 7	+ 2	+ 7	+ 3	+ 5	+ 9	+ 9	+ 5	+ 10	+ 3
3	10	8	10	6	6	2	4	7	5
+ 2	+ 11	+ 9	+ 9	+ 5	+ 7	+ 1	+ 3	+ 8	+ 4
6	4	5	9	6	2	9	7	11	2
+ 7	+ 3	+ 4	+ 10	+ 5	+ 3	+ 8	+ 8	+ 10	+ 1
8	3	4	9	2	8	6	10	5	5
+ 9	+ 2	+ 3	+ 10	+ 1	+ 7	+ 7	+ 11	+ 6	+ 4
1	5	5	11	4	10	8	7	7	3
+ 2	+ 4	+ 6	+ 10	+ 3	+ 9	+ 9	+ 6	+ 8	+ 2
9	1	4	8	8	4	3	6	11	6
+ 10	+ 2	+ 3	+ 9	+ 7	+ 5	+ 2	+ 7	+ 10	+ 5
5	4	4	6	2	11	7	10	8	2
+ 6	+ 3	+ 5	+ 7	+ 3	+ 10	+ 8	+ 9	+ 9	+ 1
6	2	4	10	1	10	9	5	8	4
+ 7	+ 3	+ 3	+ 9	+ 2	+ 11	+ 8	+ 6	+ 7	+ 5

3rd – 8th Grade Doubles Plus 1 – Math Fact Practice – Version 2

Directions: **Double the *SMALLER* addend *and add 1* to find each sum (DOUBLES PLUS 1). Use Another sheet of paper to cover the above row after it has been completed. In 5 minutes, complete as many as you can. Good Luck!!!**

2	4	7	8	3	10	4	9	7	6
+ 1	+ 5	+ 6	+ 9	+ 2	+ 11	+ 3	+ 10	+ 8	+ 5
3	9	13	17	5	21	7	19	15	11
3	7	10	3	2	5	5	10	8	6
+ 2	+ 8	+ 11	+ 4	+ 1	+ 6	+ 4	+ 9	+ 9	+ 7
5	15	21	7	3	11	9	19	17	13
8	1	6	2	4	10	8	6	11	4
+ 7	+ 2	+ 7	+ 3	+ 5	+ 9	+ 9	+ 5	+ 10	+ 3
15	3	13	5	9	19	17	11	21	7
3	10	8	10	6	6	2	4	7	5
+ 2	+ 11	+ 9	+ 9	+ 5	+ 7	+ 1	+ 3	+ 8	+ 4
5	21	17	19	11	13	3	7	15	9
6	4	5	9	6	2	9	7	11	2
+ 7	+ 3	+ 4	+ 10	+ 5	+ 3	+ 8	+ 8	+ 10	+ 1
13	7	9	19	11	5	17	15	21	3
8	3	4	9	2	8	6	10	5	5
+ 9	+ 2	+ 3	+ 10	+ 1	+ 7	+ 7	+ 11	+ 6	+ 4
17	5	7	19	3	15	13	21	11	9
1	5	5	11	4	10	8	7	7	3
+ 2	+ 4	+ 6	+ 10	+ 3	+ 9	+ 9	+ 6	+ 8	+ 2
3	9	11	21	7	19	17	13	15	5
9	1	4	8	8	4	3	6	11	6
+ 10	+ 2	+ 3	+ 9	+ 7	+ 5	+ 2	+ 7	+ 10	+ 5
19	3	7	17	15	9	5	13	21	11
5	4	4	6	2	11	7	10	8	2
+ 6	+ 3	+ 5	+ 7	+ 3	+ 10	+ 8	+ 9	+ 9	+ 1
11	7	9	13	5	21	15	19	17	3
6	2	4	10	1	10	9	5	8	4
+ 7	+ 3	+ 3	+ 9	+ 2	+ 11	+ 8	+ 6	+ 7	+ 5
13	5	7	19	3	21	17	11	15	9

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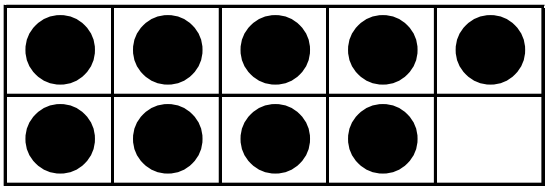
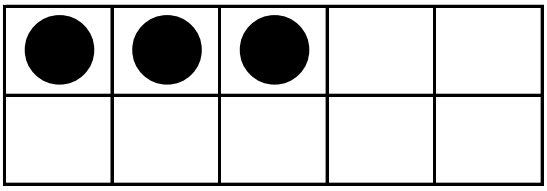
Making 10

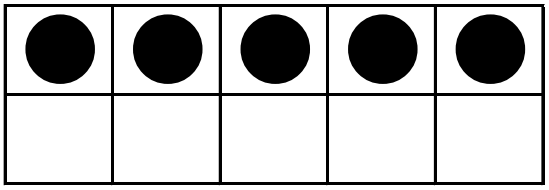
Directions: Calculate the number of dots needed to "Make 10" or sum to 10.



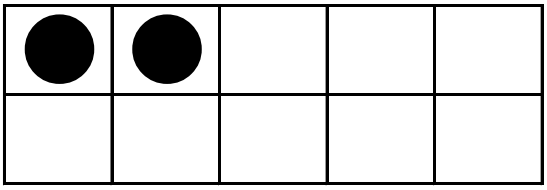
9 + ___ = 10



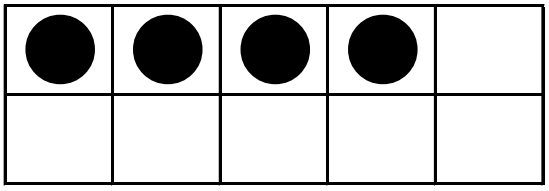
3 + ___ = 10



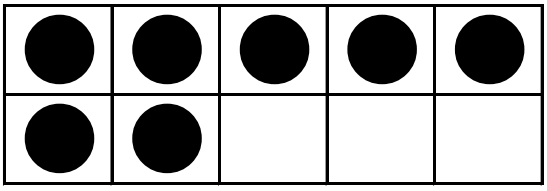
5 + ___ = 10



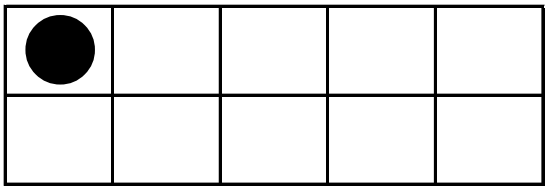
2 + ___ = 10



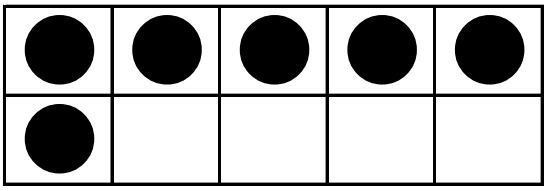
4 + ___ = 10



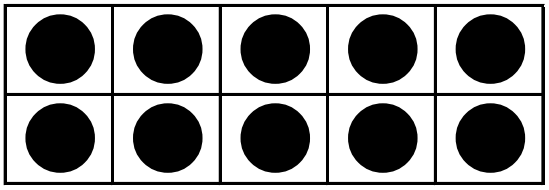
7 + ___ = 10



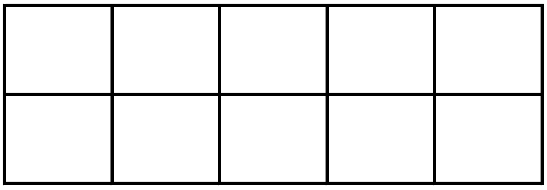
1 + ___ = 10



6 + ___ = 10



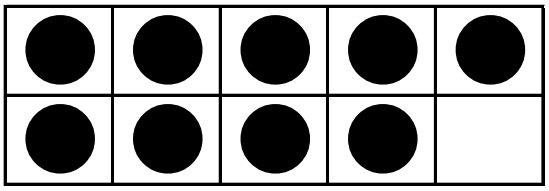
10 + ___ = 10



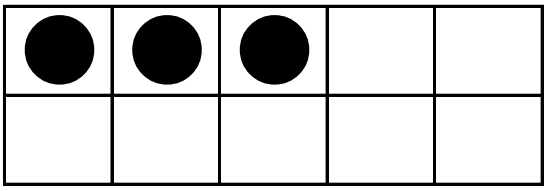
0 + ___ = 10

Making 10

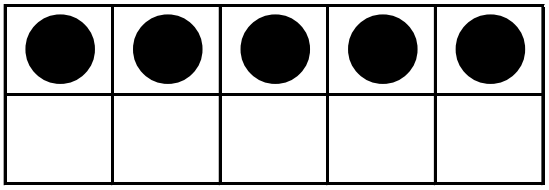
Directions: Calculate the number of dots needed to "Make 10" or sum to 10.



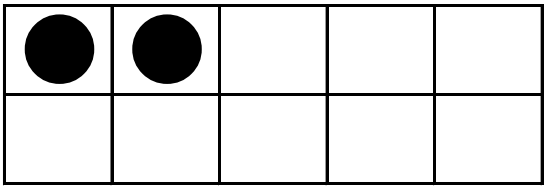
9 + 1 = 10



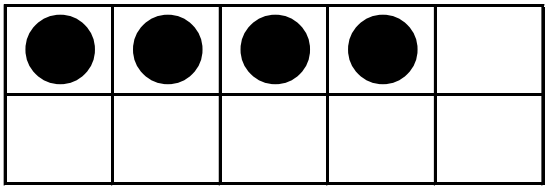
3 + 7 = 10



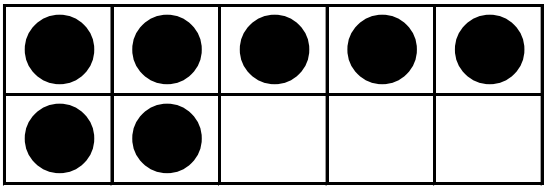
5 + 5 = 10



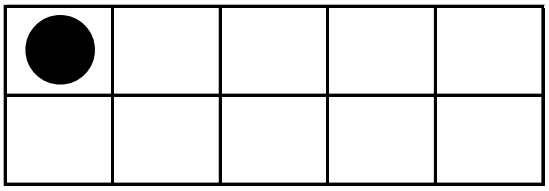
2 + 8 = 10



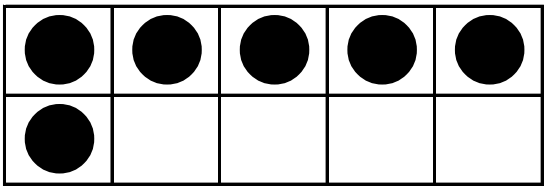
4 + 6 = 10



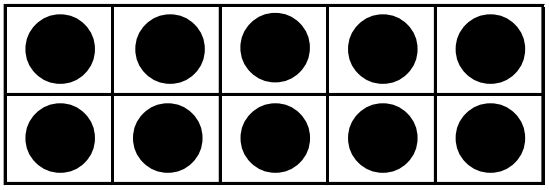
7 + 3 = 10



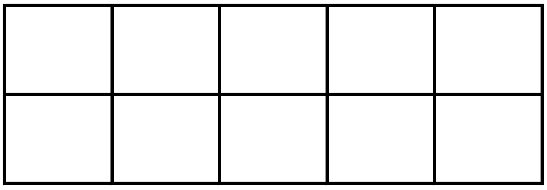
1 + 9 = 10



6 + 4 = 10



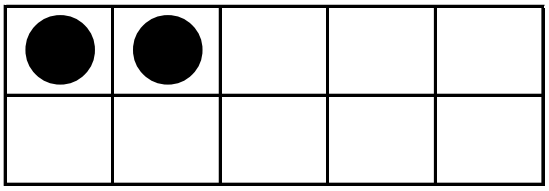
10 + 0 = 10



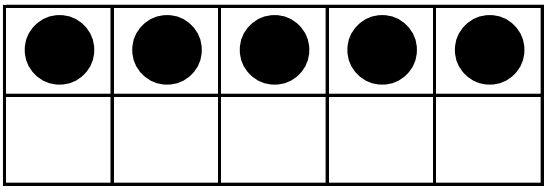
0 + 10 = 10

Making 10

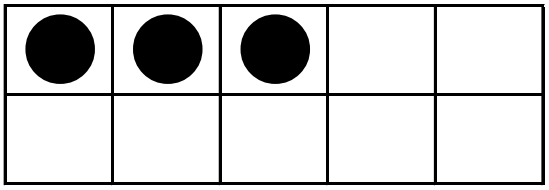
Directions: Calculate the number of dots needed to "Make 10" or sum to 10.



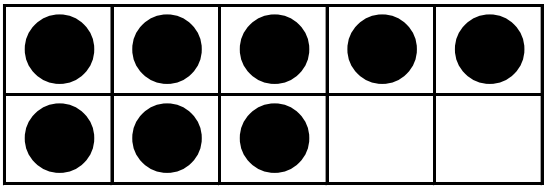
2 + ___ = 10



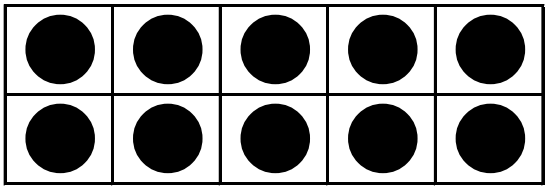
5 + ___ = 10



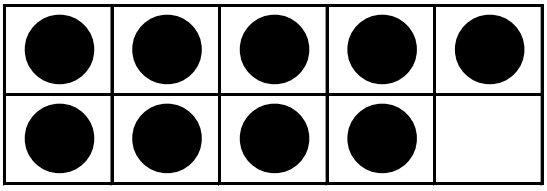
3 + ___ = 10



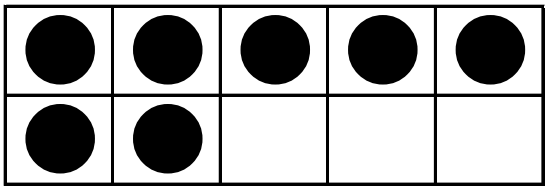
8 + ___ = 10



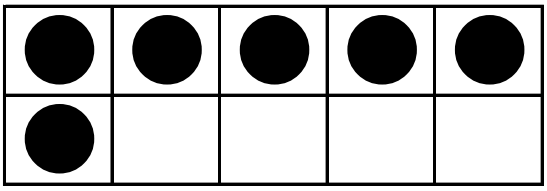
10 + ___ = 10



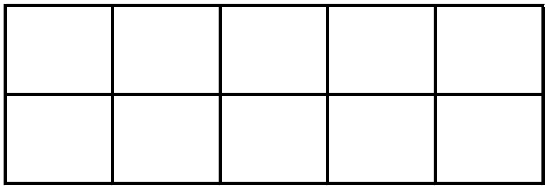
9 + ___ = 10



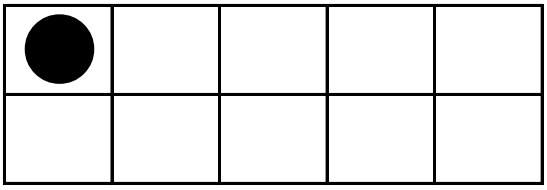
7 + ___ = 10



6 + ___ = 10



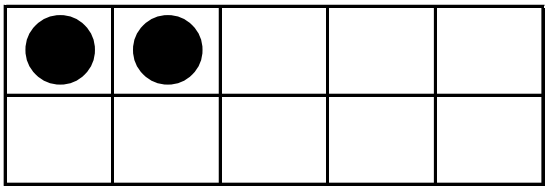
0 + ___ = 10



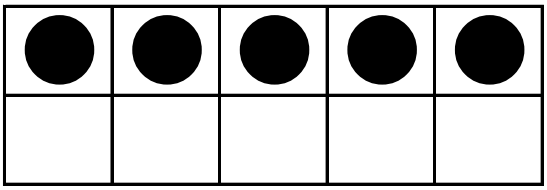
1 + ___ = 10

Making 10

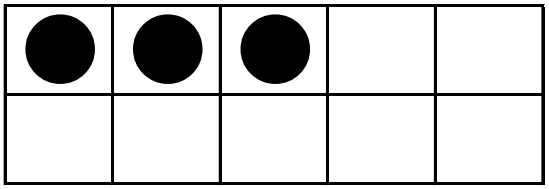
Directions: Calculate the number of dots needed to "Make 10" or sum to 10.



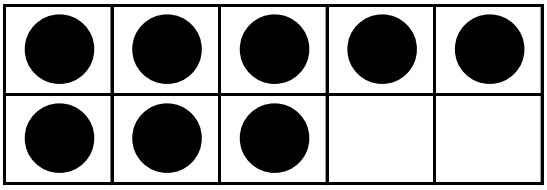
2 + **8** = 10



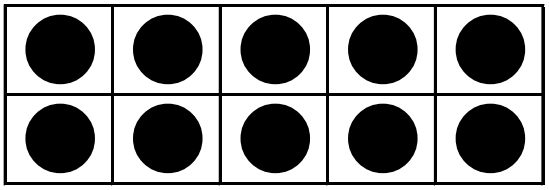
5 + **5** = 10



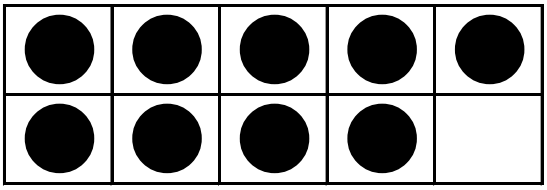
3 + **7** = 10



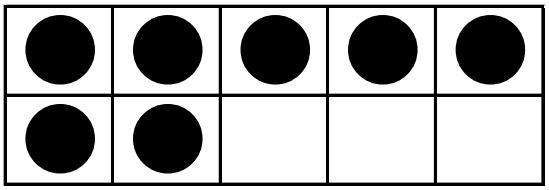
8 + **2** = 10



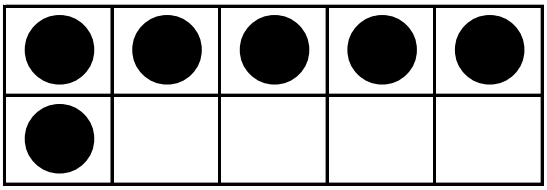
10 + **0** = 10



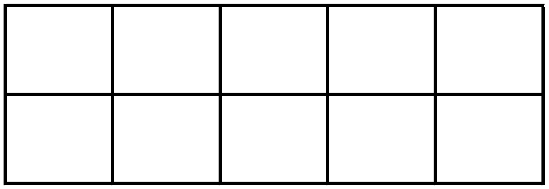
9 + **1** = 10



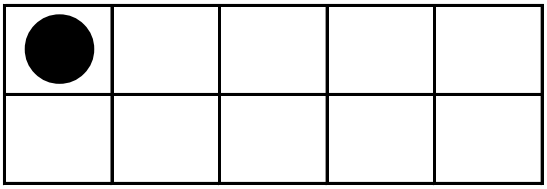
7 + **3** = 10



6 + **4** = 10



0 + **10** = 10



1 + **9** = 10

Making 10 – Level 1

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

1.) $3 + \boxed{7} = 10$

2.) $\boxed{9} + 1 = 10$

3.) $2 + \boxed{} = 10$

4.) $5 + \boxed{} = 10$

5.) $10 + \boxed{} = 10$

6.) $7 + \boxed{} = 10$

7.) $\boxed{} + 9 = 10$

8.) $\boxed{} + 6 = 10$

9.) $2 + \boxed{} = 10$

10.) $10 + \boxed{} = 10$

11.) $7 + \boxed{} = 10$

12.) $\boxed{} + 9 = 10$

13.) $\boxed{} + 2 = 10$

14.) $\boxed{} + 6 = 10$

15.) $5 + \boxed{} = 10$

16.) $3 + \boxed{} = 10$

17.) $2 + \boxed{} = 10$

18.) $\boxed{} + 9 = 10$

Making 10 – Level 1

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

1.) 3 + 7 = 10

2.) 9 + 1 = 10

3.) 2 + 8 = 10

4.) 5 + 5 = 10

5.) 10 + 0 = 10

6.) 7 + 3 = 10

7.) 1 + 9 = 10

8.) 4 + 6 = 10

9.) 2 + 8 = 10

10.) 10 + 0 = 10

11.) 7 + 3 = 10

12.) 1 + 9 = 10

13.) 8 + 2 = 10

14.) 4 + 6 = 10

15.) ★ 5 + 5 = 10

16.) 3 + 7 = 10

17.) 2 + 8 = 10

18.) 1 + 9 = 10

Making 10 – Level 1

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

1.) $6 + \boxed{4} = 10$

2.) $\boxed{1} + 9 = 10$

3.) $4 + \square = 10$

4.) $8 + \square = 10$

5.) $10 + \square = 10$

6.) $6 + \square = 10$

7.) $\square + 5 = 10$

8.) $\square + 7 = 10$

9.) $8 + \square = 10$

10.) $10 + \square = 10$

11.) $7 + \square = 10$

12.) $\square + 1 = 10$

13.) $\square + 8 = 10$

14.) $\square + 4 = 10$

15.) $5 + \square = 10$

16.) $7 + \square = 10$

17.) $8 + \square = 10$

18.) $\square + 6 = 10$

Making 10 – Level 1

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

1.) 6 + 4 = 10

2.) 1 + 9 = 10

3.) 4 + 6 = 10

4.) 8 + 2 = 10

5.) 10 + 0 = 10

6.) 6 + 4 = 10

7.) 5 + 5 = 10

8.) 3 + 7 = 10

9.) 8 + 2 = 10

10.) 10 + 0 = 10

11.) 7 + 3 = 10

12.) 9 + 1 = 10

13.) 2 + 8 = 10

14.) 6 + 4 = 10

15.) ★ 5 + 5 = 10

16.) 7 + 3 = 10

17.) 8 + 2 = 10

18.) 4 + 6 = 10

1st Grade - Making 10 – Mental Math – V1

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

10	*0*
5	*5*
8	*2*
4	*6*
2	
5	
3	
1	
8	
0	

8	
4	
3	
5	
2	
4	
9	
3	
7	
4	

7	
6	
8	
2	
5	
0	
8	
2	
5	
3	

6	
7	
5	
4	
10	
9	
2	
6	
3	
8	

1st Grade - Making 10 – Mental Math – V1

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

10	*0*
5	*5*
8	*2*
4	*6*
2	8
5	5
3	7
1	9
8	2
0	10

8	2
4	6
3	7
5	5
2	8
4	6
9	1
3	7
7	3
4	6

7	3
6	4
8	2
2	8
5	5
0	10
8	2
2	8
5	5
3	7

6	4
7	3
5	5
4	6
10	0
9	1
2	8
6	4
3	7
8	2

★

1st Grade - Making 10 – Mental Math – V2

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

0	*10*
3	*7*
8	*2*
4	*6*
6	
2	
10	
3	
5	
1	

7	
5	
2	
8	
1	
3	
0	
4	
6	
5	

6	
4	
9	
2	
5	
1	
8	
2	
0	
2	

2	
7	
1	
3	
9	
2	
0	
5	
9	
3	

1st Grade - Making 10 – Mental Math – V2

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

0	*10*
3	*7*
8	*2*
4	*6*
6	4
2	8
10	0
3	7
5	5
1	9

7	3
5	5
2	8
8	2
1	9
3	7
0	10
4	6
6	4
5	5

6	4
4	6
9	1
2	8
5	5
1	9
8	2
2	8
0	10
2	8

2	8
7	3
1	9
3	7
9	1
2	8
0	10
5	5
9	1
3	7

★

2nd Grade - Making 10 – Mental Math – V1

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

10	*0*
2	*8*
6	*4*
7	*3*
1	
5	
4	
3	
2	
1	
2	
1	
5	
0	
2	
4	
7	

7	
0	
3	
5	
2	
1	
9	
3	
7	
4	
3	
1	
9	
4	
5	
6	
9	

1	
6	
10	
2	
5	
1	
8	
2	
0	
3	
5	
3	
7	
2	
6	
4	
8	

4	
7	
1	
4	
10	
9	
2	
6	
3	
8	
5	
1	
7	
2	
9	
2	
4	

2nd Grade - Making 10 – Mental Math – V1

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

10	*0*
2	*8*
6	*4*
7	*3*
1	9
5	5
4	6
3	7
2	8
1	9
2	8
1	9
5	5
0	10
2	8
4	6
7	3

7	3
0	10
3	7
5	5
2	8
1	9
9	1
3	7
7	3
4	6
3	7
1	9
9	1
4	6
5	5
6	4
9	1

1	9
6	4
10	0
2	8
5	5
1	9
8	2
2	8
0	10
3	7
5	5
3	7
7	3
2	8
6	4
4	6
8	2

4	6
7	3
1	9
4	6
10	0
9	1
2	8
6	4★
3	7
8	2
5	5
1	9
7	3
2	8
9	1
2	8
4	6

2nd Grade - Making 10 – Mental Math – V2

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

10	*0*
6	*4*
8	*2*
3	*7*
6	
5	
2	
3	
2	
1	
0	
2	
8	
5	
9	
2	
5	

8	
5	
2	
8	
1	
9	
0	
4	
6	
5	
8	
0	
3	
9	
2	
4	
6	

1	
4	
7	
2	
5	
1	
8	
2	
0	
3	
5	
7	
6	
2	
6	
4	
8	

4	
7	
1	
3	
9	
1	
0	
2	
9	
3	
1	
5	
6	
1	
2	
3	
6	

2nd Grade - Making 10 – Mental Math – V2

Making 10 Directions: **Fill in each box so the two numbers SUM to a total of 10.**

10	*0*
6	*4*
8	*2*
3	*7*
6	4
5	5
2	8
3	7
2	8
1	9
0	10
2	8
8	2
5	5
9	1
2	8
5	5

8	2
5	5
2	8
8	2
1	9
9	1
0	10
4	6
6	4
5	5
8	2
0	10
3	7
9	1
2	8
4	6
6	4

1	9
4	6
7	3
2	8
5	5
1	9
8	2
2	8
0	10
3	7
5	5
7	3
6	4
2	8
6	4
4	6
8	2

4	6
7	3
1	9
3	7
9	1
1	9
0	10
2	8 ★
9	1
3	7
1	9
5	5
6	4
1	9
2	8
3	7
6	4

MAKING 10

Directions: **Fill in each box so the two numbers SUM to 10**.

10	*0*
9	*1*
8	*2*
7	*3*
6	
0	
1	
3	
8	
1	
10	
3	
4	
9	
1	
5	
8	
2	
1	
5	
0	
2	
4	

4	
5	
3	
5	
2	
1	
9	
3	
7	
4	
5	
2	
6	
8	
0	
2	
7	
3	
1	
9	
4	
5	
6	

9	
6	
8	
2	
5	
1	
8	
2	
0	
3	
5	
7	
6	
4	
8	
1	
0	
5	
3	
7	
2	
6	
4	

0	
7	
1	
4	
10	
9	
2	
6	
3	
8	
1	
7	
5	
2	
0	
8	
2	
5	
1	
7	
2	
9	
2	

MAKING 10

Directions: **Fill in each box so the two numbers SUM to 10.**

10	*0*
9	*1*
8	*2*
7	*3*
6	4
0	10
1	9
3	7
8	2
1	9
10	0
3	7
4	6
9	1
1	9
5	5
8	2
2	8
1	9
5	5
0	10
2	8
4	6

4	6
5	5
3	7
5	5
2	8
1	9
9	1
3	7
7	3
4	6
5	5
2	8
6	4
8	2
0	10
2	8
7	3
3	7
1	9
9	1
4	6
5	5
6	4

9	1
6	4
8	2
2	8
5	5
1	9
8	2
2	8
0	10
3	7
5	5
7	3
6	4
4	6
8	2
1	9
0	10
5	5
3	7
7	3
2	8
6	4
4	6

0	10
7	3
1	9
4	6
10	0
9	1
2	8
6	4
3	7
8	2
1	9
7	3
5	5
2	8
0	10
8	2
2	8
5	5
1	9
7	3
2	8
9	1
2	8 ★

Multiples Challenge 1 – (1 through 12)

<u>Directions:</u> In 5 minutes, fill in the table with the correct multiples by skip counting downward.

1	2	3	4	5	6	7	8	9	10	11	12
0	*0*	*0*	*0*	*0*	*0*						
1	*2*	*3*	*4*								
2	*4*	*6*									
3	*6*										
4											
5											
6											
7											
8											
9											
10											
11											
12											

Multiples Challenge 1 – (1 through 12)

Directions: **In 5 minutes, fill in the table with the correct multiples by skip counting downward.**

1	2	3	4	5	6	7	8	9	10	11	12
0	*0*	*0*	*0*	*0*	*0*	**0**	**0**	**0**	**0**	**0**	**0**
1	*2*	*3*	*4*	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	*4*	*6*	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**
3	*6*	**9**	**12**	**15**	**18**	**21**	**24**	**27**	**30**	**33**	**36**
4	**8**	**12**	**16**	**20**	**24**	**28**	**32**	**36**	**40**	**44**	**48**
5	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**
6	**12**	**18**	**24**	**30**	**36**	**42**	**48**	**54**	**60**	**66**	**72**
7	**14**	**21**	**28**	**35**	**42**	**49**	**56**	**63**	**70**	**77**	**84**
8	**16**	**24**	**32**	**40**	**48**	**56**	**64**	**72**	**80**	**88**	**96**
9	**18**	**27**	**36**	**45**	**54**	**63**	**72**	**81**	**90**	**99**	**108**
10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**
11	**22**	**33**	**44**	**55**	**66**	**77**	**88**	**99**	**110**	**121**	**132**
12	**24**	**36**	**48**	**60**	**72**	**84**	**96**	**108**	**120**	**132**	**144** ★

MULTIPLES 1-12 *Name*_____

1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0					
1	2	3	4	5							
2	4	6									
3	6										
4											
5											
6											
7											
8											
9											
10											
11											
12											

MULTIPLES 1-12 *Name*_____

1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0					
1	2	3	4	5							
2	4	6									
3	6										
4											
5											
6											
7											
8											
9											
10											
11											
12											

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MULTIPLES 1-12 Homework or Quick Classroom Assessment

X	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4								
2	4	6									
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

MULTIPLES 1-12 Homework or Quick Classroom Assessment

X	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4								
2	4	6									
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

MULTIPLES 1-12 Homework or Quick Classroom Assessment

X	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4								
2	4	6									
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

MULTIPLES 1-12 Homework or Quick Classroom Assessment

X	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4								
2	4	6									
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

3rd – 8th Grade Multiplication – Perfect Squares – Version 1

Directions: **Multiplication – Perfect Square Practice! Use another sheet of paper to cover the above row after it has been completed. Complete as many of the doubles below in 5 minutes. Good Luck!!!**

6	2	3	9	1	10	8	5	7	4
x 6	x 2	x 3	x 9	x 1	x 10	x 8	x 5	x 7	x 4
5	3	4	6	2	10	7	9	8	1
x 5	x 3	x 4	x 6	x 2	x 10	x 7	x 9	x 8	x 1
9	1	3	8	7	4	2	6	10	5
x 9	x 1	x 3	x 8	x 7	x 4	x 2	x 6	x 10	x 5
1	4	5	10	3	9	8	6	7	2
x 1	x 4	x 5	x 10	x 3	x 9	x 8	x 6	x 7	x 2
8	2	3	9	1	7	6	10	5	4
x 8	x 2	x 3	x 9	x 1	x 7	x 6	x 10	x 5	x 4
6	3	4	9	5	2	8	7	10	1
x 6	x 3	x 4	x 9	x 5	x 2	x 8	x 7	x 10	x 1
2	10	8	9	5	6	1	3	7	4
x 2	x 10	x 8	x 9	x 5	x 6	x 1	x 3	x 7	x 4
7	1	6	2	4	9	8	5	10	3
x 7	x 1	x 6	x 2	x 4	x 9	x 8	x 5	x 10	x 3
2	7	10	3	1	5	4	9	8	6
x 2	x 7	x 10	x 3	x 1	x 5	x 4	x 9	x 8	x 6
1	4	6	8	2	10	3	9	7	5
x 1	x 4	x 6	x 8	x 2	x 10	x 3	x 9	x 7	x 5

3rd – 8th Grade Multiplication – Perfect Squares – Version 1

Directions: **Multiplication – Perfect Square Practice! Use another sheet of paper to cover the above row after it has been completed. Complete as many of the doubles below in 5 minutes. Good Luck!!!**

6	2	3	9	1	10	8	5	7	4
x 6	x 2	x 3	x 9	x 1	x 10	x 8	x 5	x 7	x 4
36	**4**	**9**	**81**	**1**	**100**	**64**	**25**	**49**	**16**
5	3	4	6	2	10	7	9	8	1
x 5	x 3	x 4	x 6	x 2	x 10	x 7	x 9	x 8	x 1
25	**9**	**16**	**36**	**4**	**100**	**49**	**81**	**64**	**1**
9	1	3	8	7	4	2	6	10	5
x 9	x 1	x 3	x 8	x 7	x 4	x 2	x 6	x 10	x 5
81	**1**	**9**	**64**	**49**	**16**	**4**	**36**	**100**	**25**
1	4	5	10	3	9	8	6	7	2
x 1	x 4	x 5	x 10	x 3	x 9	x 8	x 6	x 7	x 2
1	**16**	**25**	**100**	**9**	**81**	**64**	**36**	**49**	**4**
8	2	3	9	1	7	6	10	5	4
x 8	x 2	x 3	x 9	x 1	x 7	x 6	x 10	x 5	x 4
64	**4**	**9**	**81**	**1**	**49**	**36**	**100**	**25**	**16**
6	3	4	9	5	2	8	7	10	1
x 6	x 3	x 4	x 9	x 5	x 2	x 8	x 7	x 10	x 1
36	**9**	**16**	**81**	**25**	**4**	**64**	**49**	**100**	**1**
2	10	8	9	5	6	1	3	7	4
x 2	x 10	x 8	x 9	x 5	x 6	x 1	x 3	x 7	x 4
4	**100**	**64**	**81**	**25**	**36**	**1**	**9**	**49**	**16**
7	1	6	2	4	9	8	5	10	3
x 7	x 1	x 6	x 2	x 4	x 9	x 8	x 5	x 10	x 3
49	**1**	**36**	**4**	**16**	**81**	**64**	**25**	**100**	**9**
2	7	10	3	1	5	4	9	8	6
x 2	x 7	x 10	x 3	x 1	x 5	x 4	x 9	x 8	x 6
4	**49**	**100**	**9**	**1**	**25**	**16**	**81**	**64**	**36**
1	4	6	8	2	10	3	9	7	5
x 1	x 4	x 6	x 8	x 2	x 10	x 3	x 9	x 7	x 5
1	**16**	**36**	**64**	**4**	**100**	**9**	**81**	**49**	**25**

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3rd – 8th Grade Multiplication – Perfect Squares – Version 2

Directions: **Multiplication – Perfect Square Practice! Use another sheet of paper to cover the above row after it has been completed. Complete as many of the doubles below in 5 minutes. Good Luck!!!**

1	x 1	4	x 4	6	x 6	8	x 8	2	x 2	10	x 10	3	x 3	9	x 9	7	x 7	5	x 5
2	x 2	7	x 7	10	x 10	3	x 3	1	x 1	5	x 5	4	x 4	9	x 9	8	x 8	6	x 6
7	x 7	1	x 1	6	x 6	2	x 2	4	x 4	9	x 9	8	x 8	5	x 5	10	x 10	3	x 3
2	x 2	10	x 10	8	x 8	9	x 9	5	x 5	6	x 6	1	x 1	3	x 3	7	x 7	4	x 4
6	x 6	3	x 3	4	x 4	9	x 9	5	x 5	2	x 2	8	x 8	7	x 7	10	x 10	1	x 1
6	x 6	2	x 2	3	x 3	9	x 9	1	x 1	10	x 10	8	x 8	5	x 5	7	x 7	4	x 4
5	x 5	3	x 3	4	x 4	6	x 6	2	x 2	10	x 10	7	x 7	9	x 9	8	x 8	1	x 1
9	x 9	1	x 1	3	x 3	8	x 8	7	x 7	4	x 4	2	x 2	6	x 6	10	x 10	5	x 5
1	x 1	4	x 4	5	x 5	10	x 10	3	x 3	9	x 9	8	x 8	6	x 6	7	x 7	2	x 2
8	x 8	2	x 2	3	x 3	9	x 9	1	x 1	7	x 7	6	x 6	10	x 10	5	x 5	4	x 4

3rd – 8th Grade Multiplication – Perfect Squares – Version 2

Directions: **Multiplication – Perfect Square Practice! Use another sheet of paper to cover the above row after it has been completed. Complete as many of the doubles below in 5 minutes. Good Luck!!!**

1	4	6	8	2	10	3	9	7	5
x 1	x 4	x 6	x 8	x 2	x 10	x 3	x 9	x 7	x 5
1	**16**	**36**	**64**	**4**	**100**	**9**	**81**	**49**	**25**
2	7	10	3	1	5	4	9	8	6
x 2	x 7	x 10	x 3	x 1	x 5	x 4	x 9	x 8	x 6
4	**49**	**100**	**9**	**1**	**25**	**16**	**81**	**64**	**36**
7	1	6	2	4	9	8	5	10	3
x 7	x 1	x 6	x 2	x 4	x 9	x 8	x 5	x 10	x 3
49	**1**	**36**	**4**	**16**	**81**	**64**	**25**	**100**	**9**
2	10	8	9	5	6	1	3	7	4
x 2	x 10	x 8	x 9	x 5	x 6	x 1	x 3	x 7	x 4
4	**100**	**64**	**81**	**10**	**36**	**1**	**9**	**49**	**16**
6	3	4	9	5	2	8	7	10	1
x 6	x 3	x 4	x 9	x 5	x 2	x 8	x 7	x 10	x 1
36	**9**	**16**	**81**	**25**	**4**	**64**	**49**	**100**	**1**
6	2	3	9	1	10	8	5	7	4
x 6	x 2	x 3	x 9	x 1	x 10	x 8	x 5	x 7	x 4
36	**4**	**9**	**81**	**1**	**100**	**64**	**25**	**49**	**16**
5	3	4	6	2	10	7	9	8	1
x 5	x 3	x 4	x 6	x 2	x 10	x 7	x 9	x 8	x 1
25	**9**	**16**	**36**	**4**	**100**	**49**	**81**	**64**	**1**
9	1	3	8	7	4	2	6	10	5
x 9	x 1	x 3	x 8	x 7	x 4	x 2	x 6	x 10	x 5
81	**1**	**9**	**64**	**49**	**16**	**4**	**36**	**100**	**25**
1	4	5	10	3	9	8	6	7	2
x 1	x 4	x 5	x 10	x 3	x 9	x 8	x 6	x 7	x 2
1	**16**	**25**	**100**	**9**	**81**	**64**	**36**	**49**	**4**
8	2	3	9	1	7	6	10	5	4
x 8	x 2	x 3	x 9	x 1	x 7	x 6	x 10	x 5	x 4
64	**4**	**9**	**81**	**1**	**49**	**36**	**100**	**25**	**16**

★

FIND THE MISSING FACTOR – 1, 2, and 3

Directions: **Fill in the factor that makes the number sentence mathematically correct.**

1 x ____ = 3	2 x ____ = 2	2 x ____ = 12	2 x ____ = 6
2 x ____ = 4	3 x ____ = 24	2 x ____ = 6	3 x ____ = 30
3 x ____ = 12	2 x ____ = 20	2 x ____ = 8	2 x ____ = 18
2 x ____ = 18	3 x ____ = 18	3 x ____ = 24	3 x ____ = 15
3 x ____ = 9	3 x ____ = 30	3 x ____ = 27	2 x ____ = 12
1 x ____ = 2	2 x ____ = 14	1 x ____ = 2	3 x ____ = 15
3 x ____ = 15	3 x ____ = 24	3 x ____ = 12	3 x ____ = 27
2 x ____ = 12	2 x ____ = 8	2 x ____ = 16	2 x ____ = 4
3 x ____ = 21	3 x ____ = 30	3 x ____ = 18	3 x ____ = 24
2 x ____ = 10	2 x ____ = 12	2 x ____ = 6	2 x ____ = 2
1 x ____ = 1	1 x ____ = 3	2 x ____ = 10	2 x ____ = 14
2 x ____ = 18	2 x ____ = 22	2 x ____ = 20	3 x ____ = 12
3 x ____ = 24	2 x ____ = 20	2 x ____ = 24	2 x ____ = 16
2 x ____ = 6	2 x ____ = 8	3 x ____ = 6	2 x ____ = 10
3 x ____ = 15	3 x ____ = 12	3 x ____ = 21	3 x ____ = 21
2 x ____ = 8	2 x ____ = 4	2 x ____ = 24	2 x ____ = 10
3 x ____ = 3	1 x ____ = 2	2 x ____ = 2	1 x ____ = 3
2 x ____ = 4	2 x ____ = 16	2 x ____ = 8	2 x ____ = 12
1 x ____ = 2	3 x ____ = 9	1 x ____ = 2	3 x ____ = 12
2 x ____ = 14	1 x ____ = 1	2 x ____ = 2	3 x ____ = 24
3 x ____ = 27	2 x ____ = 24	3 x ____ = 30	2 x ____ = 24
3 x ____ = 30	3 x ____ = 27	2 x ____ = 24	3 x ____ = 27
2 x ____ = 16	2 x ____ = 18	2 x ____ = 14	2 x ____ = 12
1 x ____ = 3	2 x ____ = 20	3 x ____ = 9	2 x ____ = 20

FIND THE MISSING FACTOR – 1, 2, and 3

Directions: **Fill in the factor that makes the number sentence mathematically correct.**

1 x 3 = 3	2 x 1 = 2	2 x 6 = 12	2 x 3 = 6
2 x 2 = 4	3 x 8 = 24	2 x 3 = 6	3 x 10 = 30
3 x 4 = 12	2 x 10 = 20	2 x 4 = 8	2 x 9 = 18
2 x 9 = 18	3 x 6 = 18	3 x 8 = 24	3 x 5 = 15
3 x 3 = 9	3 x 10 = 30	3 x 9 = 27	2 x 6 = 12
1 x 4 = 2	2 x 7 = 14	1 x 2 = 2	3 x 5 = 15
3 x 5 = 15	3 x 8 = 24	3 x 4 = 12	3 x 9 = 27
2 x 6 = 12	2 x 4 = 8	2 x 8 = 16	2 x 2 = 4
3 x 7 = 21	3 x 10 = 30	3 x 6 = 18	3 x 8 = 24
2 x 5 = 10	2 x 6 = 12	2 x 3 = 6	2 x 1 = 2
1 x 4 = 1	1 x 3 = 3	2 x 5 = 10	2 x 7 = 14
2 x 9 = 18	2 x 11 = 22	2 x 10 = 20	3 x 4 = 12
3 x 8 = 24	2 x 10 = 20	2 x 12 = 24	2 x 8 = 16
2 x 3 = 6	2 x 4 = 8	3 x 2 = 6	2 x 5 = 10
3 x 5 = 15	3 x 4 = 12	3 x 7 = 21	3 x 7 = 21
2 x 4 = 8	2 x 2 = 4	2 x 12 = 24	2 x 5 = 10
3 x 1 = 3	1 x 2 = 2	2 x 1 = 2	1 x 3 = 3
2 x 2 = 4	2 x 8 = 16	2 x 4 = 8	2 x 6 = 12
1 x 2 = 2	3 x 3 = 9	1 x 2 = 2	3 x 4 = 12
2 x 7 = 14	1 x 1 = 1	2 x 1 = 2	3 x 2 = 24
3 x 9 = 27	2 x 12 = 24	3 x 10 = 30	2 x 12 = 24
3 x 10 = 30	3 x 9 = 27	2 x 12 = 24	3 x 9 = 27
2 x 8 = 16	2 x 9 = 18	2 x 7 = 14	2 x 6 = 12
1 x 3 = 3	2 x 10 = 20	3 x 3 = 9	★ 2 x 10 = 20

FIND THE MISSING FACTOR – 4, 5, and 6

Directions: **Fill in the factor that makes the number sentence mathematically correct.**

1 x ____ = 4	5 x ____ = 5	6 x ____ = 12	6 x ____ = 6
4 x ____ = 8	4 x ____ = 24	6 x ____ = 6	6 x ____ = 30
6 x ____ = 12	6 x ____ = 48	4 x ____ = 8	5 x ____ = 30
5 x ____ = 15	4 x ____ = 24	5 x ____ = 40	6 x ____ = 54
6 x ____ = 18	5 x ____ = 30	5 x ____ = 30	6 x ____ = 60
1 x ____ = 6	4 x ____ = 8	1 x ____ = 6	5 x ____ = 55
5 x ____ = 15	5 x ____ = 45	6 x ____ = 54	4 x ____ = 20
4 x ____ = 12	4 x ____ = 8	6 x ____ = 18	5 x ____ = 40
4 x ____ = 24	4 x ____ = 40	4 x ____ = 20	5 x ____ = 45
6 x ____ = 54	5 x ____ = 25	6 x ____ = 48	6 x ____ = 54
5 x ____ = 10	6 x ____ = 36	4 x ____ = 12	4 x ____ = 12
4 x ____ = 20	4 x ____ = 24	5 x ____ = 20	5 x ____ = 15
5 x ____ = 20	4 x ____ = 28	6 x ____ = 24	4 x ____ = 16
6 x ____ = 6	5 x ____ = 35	6 x ____ = 6	5 x ____ = 50
6 x ____ = 18	6 x ____ = 54	5 x ____ = 10	6 x ____ = 66
5 x ____ = 30	6 x ____ = 42	4 x ____ = 24	5 x ____ = 10
6 x ____ = 36	1 x ____ = 5	6 x ____ = 48	1 x ____ = 5
4 x ____ = 4	4 x ____ = 16	6 x ____ = 18	4 x ____ = 12
6 x ____ = 24	5 x ____ = 35	1 x ____ = 5	5 x ____ = 45
4 x ____ = 12	1 x ____ = 6	5 x ____ = 5	6 x ____ = 24
4 x ____ = 40	4 x ____ = 12	5 x ____ = 30	6 x ____ = 54
5 x ____ = 50	6 x ____ = 30	4 x ____ = 24	6 x ____ = 36
4 x ____ = 16	5 x ____ = 15	5 x ____ = 25	5 x ____ = 25
1 x ____ = 6	4 x ____ = 40	6 x ____ = 54	6 x ____ = 54

FIND THE MISSING FACTOR – 4, 5, and 6

Directions: **Fill in the factor that makes the number sentence mathematically correct.**

1 x 4 = 4	5 x 1 = 5	6 x 2 = 12	6 x 1 = 6
4 x 2 = 8	4 x 6 = 24	6 x 1 = 6	6 x 5 = 30
6 x 2 = 12	6 x 8 = 48	4 x 2 = 8	5 x 6 = 30
5 x 3 = 15	4 x 6 = 24	5 x 8 = 40	6 x 9 = 54
6 x 3 = 18	5 x 6 = 30	5 x 6 = 30	6 x 10 = 60
1 x 6 = 6	4 x 2 = 8	1 x 6 = 6	5 x 11 = 55
5 x 3 = 15	5 x 8 = 45	6 x 9 = 54	4 x 5 = 20
4 x 3 = 12	4 x 2 = 8	6 x 3 = 18	5 x 8 = 40
4 x 6 = 24	4 x 10 = 40	4 x 5 = 20	5 x 9 = 45
6 x 3 = 54	5 x 5 = 25	6 x 8 = 48	6 x 9 = 54
5 x 2 = 10	6 x 6 = 36	4 x 3 = 12	4 x 3 = 12
4 x 5 = 20	4 x 6 = 24	5 x 4 = 20	5 x 3 = 15
5 x 4 = 20	4 x 7 = 28	6 x 4 = 24	4 x 4 = 16
6 x 1 = 6	5 x 7 = 35	6 x 1 = 6	5 x 10 = 50
6 x 3 = 18	6 x 9 = 54	5 x 2 = 10	6 x 11 = 66
5 x 6 = 30	6 x 7 = 42	4 x 6 = 24	5 x 2 = 10
6 x 6 = 36	1 x 5 = 5	6 x 8 = 48	1 x 5 = 5
4 x 1 = 4	4 x 4 = 16	6 x 3 = 18	4 x 3 = 12
6 x 4 = 24	5 x 7 = 35	1 x 5 = 5	5 x 9 = 45
4 x 3 = 12	1 x 6 = 6	5 x 1 = 5	6 x 4 = 24
4 x 10 = 40	4 x 3 = 12	5 x 6 = 30	6 x 9 = 54
5 x 10 = 50	6 x 5 = 30	4 x 3 = 24	6 x 6 = 36
4 x 2 = 16	5 x 3 = 15	5 x 5 = 25	5 x 5 = 25
1 x 6 = 6	4 x 10 = 40	6 x 9 = 54	★ 6 x 9 = 54

FIND THE MISSING FACTOR – 7, 8, and 9

Directions: **Fill in the factor that makes the number sentence mathematically correct.**

1 x ____ = 7	9 x ____ = 9	9 x ____ = 18	7 x ____ = 63
7 x ____ = 7	7 x ____ = 28	7 x ____ = 7	8 x ____ = 56
8 x ____ = 16	8 x ____ = 48	9 x ____ = 18	7 x ____ = 49
7 x ____ = 14	7 x ____ = 28	7 x ____ = 49	9 x ____ = 54
9 x ____ = 18	8 x ____ = 64	8 x ____ = 80	7 x ____ = 70
1 x ____ = 8	7 x ____ = 7	1 x ____ = 7	8 x ____ = 88
8 x ____ = 24	9 x ____ = 45	7 x ____ = 14	6 x ____ = 18
7 x ____ = 21	7 x ____ = 14	8 x ____ = 32	7 x ____ = 49
8 x ____ = 24	9 x ____ = 63	8 x ____ = 24	9 x ____ = 45
9 x ____ = 36	7 x ____ = 70	7 x ____ = 49	7 x ____ = 7
7 x ____ = 70	8 x ____ = 32	8 x ____ = 64	9 x ____ = 81
7 x ____ = 21	9 x ____ = 27	9 x ____ = 72	8 x ____ = 80
8 x ____ = 32	7 x ____ = 28	8 x ____ = 72	7 x ____ = 14
7 x ____ = 42	8 x ____ = 64	7 x ____ = 49	8 x ____ = 24
9 x ____ = 90	7 x ____ = 63	8 x ____ = 16	7 x ____ = 77
9 x ____ = 54	9 x ____ = 54	9 x ____ = 27	8 x ____ = 16
7 x ____ = 42	1 x ____ = 9	8 x ____ = 48	1 x ____ = 8
9 x ____ = 9	7 x ____ = 42	7 x ____ = 35	7 x ____ = 70
7 x ____ = 56	9 x ____ = 90	1 x ____ = 9	7 x ____ = 56
8 x ____ = 56	1 x ____ = 8	7 x ____ = 7	8 x ____ = 24
8 x ____ = 72	8 x ____ = 56	7 x ____ = 35	7 x ____ = 35
7 x ____ = 49	7 x ____ = 63	8 x ____ = 24	8 x ____ = 56
8 x ____ = 16	8 x ____ = 64	9 x ____ = 63	7 x ____ = 49
1 x ____ = 9	7 x ____ = 35	8 x ____ = 64	8 x ____ = 72

FIND THE MISSING FACTOR – 7, 8, and 9

Directions: **Fill in the factor that makes the number sentence mathematically correct.**

1 x 7 = 7	9 x 1 = 9	9 x 2 = 18	7 x 9 = 63
7 x 1 = 7	7 x 4 = 28	7 x 1 = 7	8 x 7 = 56
8 x 2 = 16	8 x 6 = 48	9 x 2 = 18	7 x 7 = 49
7 x 2 = 14	7 x 4 = 28	7 x 7 = 49	9 x 6 = 54
9 x 2 = 18	8 x 8 = 64	8 x 10 = 80	7 x 10 = 70
1 x 8 = 8	7 x 1 = 7	1 x 7 = 7	8 x 11 = 88
8 x 3 = 24	9 x 5 = 45	7 x 2 = 14	6 x 3 = 18
7 x 3 = 21	7 x 2 = 14	8 x 4 = 32	7 x 7 = 49
8 x 3 = 24	9 x 7 = 63	8 x 3 = 24	9 x 5 = 45
9 x 4 = 36	7 x 10 = 70	7 x 7 = 49	7 x 1 = 7
7 x 10 = 70	8 x 4 = 32	8 x 8 = 64	9 x 9 = 81
7 x 3 = 21	9 x 3 = 27	9 x 8 = 72	8 x 10 = 80
8 x 4 = 32	7 x 4 = 28	8 x 9 = 72	7 x 2 = 14
7 x 6 = 42	8 x 8 = 64	7 x 7 = 49	8 x 3 = 24
9 x 10 = 90	7 x 9 = 63	8 x 2 = 16	7 x 11 = 77
9 x 6 = 54	9 x 6 = 54	9 x 3 = 27	8 x 2 = 16
7 x 7 = 42	1 x 9 = 9	8 x 6 = 48	1 x 8 = 8
9 x 2 = 9	7 x 6 = 42	7 x 5 = 35	7 x 10 = 70
7 x 8 = 56	9 x 10 = 90	1 x 9 = 9	7 x 8 = 56
8 x 7 = 56	1 x 8 = 8	7 x 1 = 7	8 x 3 = 24
8 x 9 = 72	8 x 7 = 56	7 x 5 = 35	7 x 5 = 35
7 x 7 = 49	7 x 9 = 63	8 x 3 = 24	8 x 7 = 56
8 x 2 = 16	8 x 8 = 64	9 x 7 = 63	7 x 7 = 49
1 x 9 = 9	7 x 5 = 35	8 x 8 = 64	★ 8 x 9 = 72

